Dynamic segmental diagnostics (DSD testing)

I.V. Boitsov
(LLC "Spectral-dynamic systems", Minsk)

Dynamic Segmentary Diagnostics (DSD-test)

IV Boitsov
Spectral-dynamical systems ltd. (Minsk)

SUMMARY

The purpose of the work is to develop a method for testing skin sympathetic reactions, its theoretical justification and study of the possibility of using it in practical medicine on the basis of a conceptual understanding of the data obtained in the course of the study. We examined patients with various pathologies and practically healthy people (more than 15,000 people in total) aged from 2 months to 93 years. A clinical and experimental study was carried out and a theoretical justification was given to the method of dynamic segmental diagnostics. The indications for the use of DSD testing in the practice of a medical doctor, a surgical doctor, a manual therapy doctor, and a reflexologist have been determined. According to the results of the study on the human body, 12 pairs of skin segments of the vegetative supply were identified. The concept is proposed and the existence of the vegetotome is proved,

Key words: autonomic nervous system, skin sympatheticreactions, dynamic segmental diagnostics, skin segments of vegetative supply, vegetation, acupuncture.

RESUME

The purpose of work was to provide a method for testing skin sympathetic reactions, its theoretical rationale and study the possibility of application in medical practice based on the conceptual understanding of data obtained in the course of the study. We surveyed patients with various pathology and practically healthy people in total of 15000 people aged from 2 months to 93 years. We conducted clinical and experimental study, theoretical justification of the method of dynamic segmental diagnosis. Indications for the use of DSD in practice of medical doctor, surgical doctor, manual-therapist, reflex-therapist were determined. According to study 12 pairs of skin segments of vegetative provision on the human body have been allocated. The concept and the existence vegetotoma as part of the embryonic element of the autonomic nervous system,

Keywords: autonomic nervous system, skin sympathetic response, dynamic segmental diagnosis, skin segments vegetative provision, vegetotome, acupuncture.

Introduction

In modern medicine, a large number of methods are used to study the functional state of the autonomic nervous system, each of which brings us closer to the correct understanding of the place of autonomic dysfunctions in the general spectrum of pathological changes in the body [1]. In addition, it is impossible to determine the role and significance of autonomic dysfunctions without solving the fundamental problem of identifying the systemic (morphological and functional) and intersystem (neurosomatic - neurovegetative - meridian) organization of autonomic support. In this regard, the development and implementation of new methods for assessing the state of the autonomic nervous system into the practice of a modern doctor remains relevant.

The aim of this work was to develop a method for testing skin sympathetic reactions, its theoretical justification and study of the possibility of application in practical medicine on the basis of a conceptual understanding of the data obtained in the course of the study. The tasks of the study included: 1) determination of the optimal parameters of the testing electric current for the initiation of skin sympathetic reactions; 2) development of algorithms for interpreting the results of testing sympathetic skin reactions; 3) clinical and experimental research using the developed testing method; 4) clinical research using the developed testing method.

Objects and research methods

More than 15,000 people were examined - children, men and women aged from 2 months to 93 years. In the clinical and experimental part of the work, the following groups were distinguished: 1) patients with extensive lesions of the neural apparatus along the long axis of the spinal cord at the level of the thoracic segments; 2) patients with lesions of 1–2 segments in any part of the spinal cord; 3) patients with loss of superficial, pain and temperature sensitivity in various areas of the skin; 4) patients with circulatory disorders in the brain with the development of hemiparesis; 5) a group of practically healthy people. The general group of clinical trials included patients with various pathologies of the cardiovascular, bronchopulmonary, hepatobiliary, digestive, genitourinary, immune, nervous, endocrine systems, musculoskeletal system,

Testing of skin sympathetic reactions (CSR) was carried out on the POST-12.2 device (Registration certificate of the Ministry of Health and Social Development of the Russian Federation No. 29/23030700 / 2834-02) using the method of dynamic segmental diagnostics (DSD-testing, English Dynamic Segmentary Diagnostics or DSD-test).

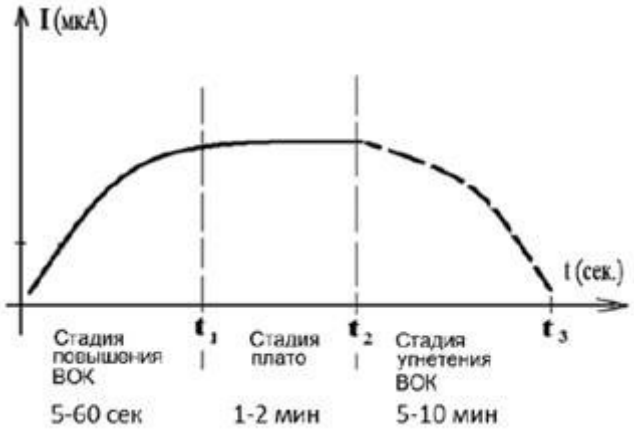
Development of test current parameters

It has been proven that the electrical properties of the skin depend on the nature of its vegetative (sympathetic) supply. For testing reflex skin sympathetic responses as a stimulus

electric current was used. Studies have shown that the optimal for testing DAC is a direct current with a voltage of 6 to 21 V and a current strength with closed electrodes from 150 to 250 μA. With a decrease in the above parameters of the testing current due to the low intensity of skin sympathetic reactions, interpretation of the test results is practically impossible, and when using a current with a strength of less than 20 μA and a voltage of less than 3 V, it is not possible to induce a reflex skin-sympathetic reaction. With an increase in voltage and current strength above the optimal values, the response skin-sympathetic reaction is quickly inhibited and cannot be interpreted. Due to the polarization of the skin when a direct current is passed through it and, as a consequence, a decrease in the intensity of the reflex sympathetic skin reaction 3-7 seconds after the start of the test,2, place a cotton pad moistened with saline. Passive electrode with positive polarity and an area of contact with the skin of about 25 cm2the patient holds in his hand. Before testing, the passive electrode is moistened in physiological saline. During testing, the voltage at the initially set values is stabilized, and at intervals of 0.1 seconds, the values of the current between the electrodes are fixed. As the testing current passes through the skin from the start of testing and for 10–60 seconds, the device records a gradual increase in current strength. This phase of the skin sympathetic response is defined as "the stage of increasing the vegetative supply of the skin (WOC)" (Fig. 1). After the specified time has elapsed, the increase in current strength stops, and this indicator stabilizes. The second phase of the sympathetic cutaneous reaction in Fig. 1 is referred to as the "stage of stabilization of the WOC" or "stage of the plateau". After a time interval of 1–2 minutes, the device begins to record a decrease in the current passing through the skin between the active and passive electrodes. Ultimately, after a time of 5–10 minutes, the current strength indicator reaches the initial values recorded before testing. In fig. 1, this phase of DAC is designated as the "stage of inhibition of VOC". This method of testing skin sympathetic responses is one of the methods of segmental neurofunctional diagnostics, and we called it dynamic segmental diagnostics or DSD testing [2].

Interpretation of test results

Interpretation of the first phase of the reflex skin sympathetic reaction is carried out by us as follows. The impact of the testing current on the nerve receptors of the skin causes a depolarization effect in the latter, which leads to the appearance of afferent impulses, and by means of intercalary neurons, the excitation of effector autonomic neurons occurs, as a result, the vegetotrophic supply of the skin under the active electrode is activated with a decrease in cutaneous electrical resistance, which is accompanied by an increase in the current strength passing through the skin between the active and passive electrodes.



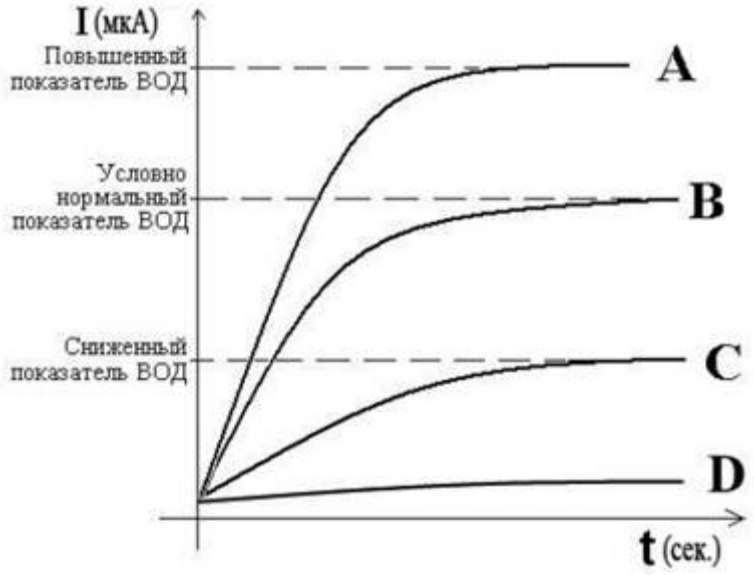
Rice. 1. DSD testing: stages of sympathetic cutaneous reaction.

The stabilization of the current strength indicators against the background of the continuing effect of electric current on the nerve receptors of the skin in the second phase of the sympathetic skin reaction is explained by the stabilization of the functional state of the effector autonomic neurons activated in the first phase of CSR. At the same time, the degree of vegetative supply of the skin does not change, but remains stably high. The electrical resistance of the skin remains constant, and the device records the current values that do not change during the second phase.

The onset of the third phase of the sympathetic skin reaction, during which, against the background of exposure to electric current on the nerve receptors, the device records a decrease in the current strength, is due to the onset of inhibition of effector autonomic neurons, which are no longer able to maintain the excited state achieved during testing. As a result, during the course of the third phase, the previously activated vegetative supply of the skin decreases, which leads to an increase in the electrical resistance of the skin and causes a decrease in the current strength between the electrodes.

Based on the above interpretation of the stages of a reflex sympathetic cutaneous reaction, it is advisable to carry out the following basic assessments based on the test results:

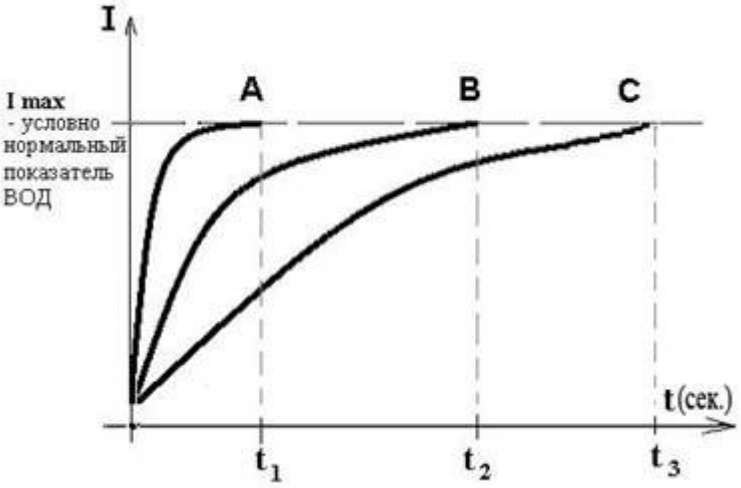
1) assess the indicator of vegetative support of activity (VOD), i.e. the current values that the device records at the "plateau stage". This indicator characterizes the degree of vegetotrophic provision of the tested skin area. In fig. 2 shows graphs characterizing an increase (A), a decrease (C), a physiological state (B) of the VOD indicator and a graph of the absence of a reflex sympathetic skin reaction (D);



Rice. 2 DSD testing: options for changing the indicator of vegetative ensuring activities.

2) assess the indicator of autonomic reactivity (VR) of the first phase of the CSR, those. amplitude-time (dynamic) characteristic of this stage. This indicator is calculated as the ratio of the maximum current strength to the time of the onset of the "plateau stage". In fig. 3 shows graphs characterizing hyperreactivity - increase (A), hyporeactivity - decrease (C) and physiological state (B) of the autonomic reactivity index of the first phase of CSR. Depending on the goals of DSD testing, it may be advisable to calculate the indicator of the vegetative reactivity of the third phase of the DAC - the ratio of the maximum current strength to the duration of the third phase;

3) estimate the duration of the second phase of the CSR ("plateau stage").



Rice. 3 DSD testing: options for changing the indicator of the vegetative reactivity of the first phase of sympathetic skin reaction.

The presented above appraisals results testing skin sympathetic reactions suggest the use of the method of dynamic segmental diagnostics by doctors of a surgical profile: firstly, to assess the vegetative support of the skin area on which a surgical incision is planned, in order to prevent long-term non-healing surgical wounds; secondly, in plastic surgery to assess the vegetative supply of skin areas intended for further transplantation; thirdly, in microsurgery for postoperative control over the restoration of autonomic support of the limb after avulsion injury.

Research results

Clinical and experimental research

For the theoretical substantiation of the developed method for testing skin sympathetic reactions, it was necessary to conduct a number of clinical and experimental studies in specially selected groups of patients.

The first group: patients with lesions of a sufficiently large volume of the spinal cord along its long axis at the level of the mid-lower thoracic segments. This type of pathology is typical for patients with spinal cord ischemia below the level of Th2 or Th8 segments during compression of a. radiculomedullaris anterior magna for the main (pausegmental) type of blood supply to the spinal cord [3] and for patients with radiation damage to the spinal neurons of the thoracic region after radiation therapy of the sternum bone marrow. DSD testing of this group of patients showed that with such a pathology, skin sympathetic reactions on the lower extremities cannot be elicited, or they are of very low intensity. In this case, the graph of the change in the current strength practically does not have an excitation stage (Fig. 2D). The results of the study of patients of the first clinical experimental group made it possible to conclude that there is a direct dependence of the CSR intensity on the state of the autonomic neurons of the thoracic spinal cord and to exclude the dependence of the current strength indicators during the DSD testing on the effects of electrochemical polarization during the passage of direct current in the "metal-electrolyte" system. ... The revealed regularity of the distribution of CSR intensity in patients of the first group makes it possible to use DSD testing for preliminary diagnosis of latent ischemia of the spinal cord with the main variant of its blood supply.

The second group: patients with traumatic injuries of 1–2 segments in any part of the spinal cord, including patients with complete interruption of the spinal cord. DSD testing of this group of patients showed that with such a pathology, there are no significant differences in the intensity of CSR in the skin areas above and below the injury. The results of the study of the patients of the group allowed us to conclude that the reflex arc of the sympathetic skin reaction is segmental in nature, without a closure in the cerebral cortex and subcortical centers. But later, when examining patients of the general group, we found a low intensity of CSR in all areas of the skin in patients with a decrease in the activity of higher autonomic centers against the background of long-term

pathological processes in the body. On the other hand, during psychoemotional arousal of a person, the intensity of the CSR increased in all skin areas, and during sleep, its decrease was observed. Such a general change in the intensity of skin-sympathetic reactions, apparently, is due to the central mechanisms of humoral regulation. By the nature of changes in the intensity of CSR during psychoemotional arousal of a person and during sleep, it seems possible to assess the central mechanisms of humoral regulation.

The third group: patients with loss of superficial, pain and temperature sensitivity in various areas of the skin. This category of patients consisted of patients with spinal nerve compression on the background of herniated intervertebral discs and patients with traumatic injuries of peripheral nerves. DSD testing of skin areas with hypo- and anesthesia that, according to electroneuromyography, have damage to thick myelin fibers, showed that the intensity of CSR in such skin areas did not significantly differ from reactions on skin with normal sensitivity. A significant decrease in the intensity of CSR (Fig. 2D) was observed only in areas of the skin with a complete break of the nerve, including thin vegetative fibers. The results of the study of patients of the third clinical experimental group allowed us to conclude that that the afferent link in reflex skin sympathetic reactions are not receptors and pathways of neurons of superficial, pain or temperature sensitivity. The afferent impulse of the reflex sympathetic skin reaction spreads along the pathways of autonomic sensitivity, therefore, it seems to us incorrect to correlate the autonomic reactions of the skin with the segments of superficial sensitivity. On the other hand, we consider it possible to determine the degree of damage to the autonomic fibers of damaged and pathologically altered peripheral nerves using DSD testing. The afferent impulse of the reflex sympathetic skin reaction spreads along the pathways of autonomic sensitivity, therefore, it seems to us incorrect to correlate the autonomic reactions of the skin with the segments of superficial sensitivity. On the other hand, we consider it possible to determine the degree of damage to the autonomic fibers of damaged and pathologically altered peripheral nerves using DSD testing. The afferent impulse of the reflex sympathetic skin reaction spreads along the pathways of autonomic sensitivity, therefore, it seems to us incorrect to correlate the autonomic reactions of the skin with the segments of superficial sensitivity. On the other hand, we consider it possible to determine the degree of damage to the autonomic fibers of damaged and pathologically altered peripheral nerves using DSD testing.

The fourth group: patients with hemiparesis with cerebral circulatory disorders. When examining patients with hemisyndromes against the background of brain pathology and the development of spastic hemiparesis, the following was revealed: on the side of hemiparesis, sympathetic skin reactions are more active on the inner surface of the arm and the outer surface of the leg, which is apparently due to the activation of the sympathetic trophic innervation of muscle groups with increased tone (increased sympathetic trophic innervation provides static muscle work to maintain tone) and an increase in sympathetic activity in skin areas receiving vegetotrophic support from the same segments of the spinal cord. Such a distribution of the activity of skin sympathetic reactions indicates the unity of the segmental autonomic support of certain tendon-muscle groups and skin segments. In clinical practice, this pattern can be used to control the restoration of cerebral circulation in the above category of patients, in the diagnosis of transient cerebral circulation disorders, as well as in sports medicine to assess the vegetotrophic regulation of specific muscle groups.

Fifth group: practically healthy people. All subjects in this group

Observations predominantly on the skin of the distal extremities (hand and foot) during DSD testing showed significantly different intensity of skin sympathetic reactions, but as the tested skin zones approached the spine, the indices of autonomic support of the CSR activity gradually leveled off and became almost the same in the paravertebral zones. Apparently, the shorter the path of the afferent and efferent impulses when testing skin sympathetic responses, the less the neural apparatus of the fewer spinal cord segments is involved in the reflex response. Therefore, when testing skin areas on the distal extremities, as the most distant from the spine, a whole group of segments with varying degrees of neuronal excitation in each of them is involved in the response. But with the maximum approach to the spine, a stimulus of the same power produces a sufficiently powerful response of the neurons of one segment of the same intensity and relatively less intense responses from neurons of adjacent segments. As a result, in all paravertebral zones, almost the same indicators of autonomic support of activity are recorded. This regularity of the distribution of the intensity of skin sympathetic reactions makes it possible to use DSD testing in the paravertebral zones to determine the functional state of the spinal nerves and control medical manipulations in the practice of a manual therapy physician [4].

It should be noted that with all the difference in the intensity of skin-sympathetic reactions in the distal parts of the extremities, the intensity in the same skin areas in healthy people was at the same level. The highest intensity was recorded on the dorsum of the hand on the skin area bounded by fingers II-IV on the skin projections of the extensor tendons of the little finger and the long muscle abducting the thumb of the hand. The lowest intensity was recorded on the dorsum of the foot in the area of skin extending from the first interdigital space to the anterior edge of the medial malleolus, and on the skin area extending from the fourth interdigital space to the anterior edge of the lateral malleolus.

Clinical researches

In the clinical part of our work, ADI testing was mainly carried out up to the “plateau stage”. Studies of patients with various pathologies have revealed patterns of changes in the intensity of skin sympathetic reactions in different parts of the human body, depending on the involvement of certain visceral systems of the body in the pathological process. In addition, the change in the intensity of the CSR of a specific skin zone directly depends on the severity of the pathological process and the degree of damage to the corresponding visceral system. At the same time, on the skin of the distal parts of the extremities in an acute process or extensive damage to any visceral system, a fairly clearly delineated area of the skin is determined, where the intensity of the CSR differs several times from the areas adjacent to it.

visceral systems have a typical localization and are located in the form of segments elongated along the limb ("stripe" type of distribution). Thus, on the skin of the distal extremities, 12 symmetrical skin segments of autonomic support (CSP) were identified, six segments on each limb, where the intensity of reflex skin-sympathetic reactions depended on the degree of damage to the corresponding visceral systems of the body [5, 6]. Adjacent segments have areas of overlapping innervation. In addition, above the folds of the wrist and ankle joints, the formation of the cross-innervation of the CSVO is not limited by the laws of segment contiguity. It is recommended to use skin segments of vegetative support for medical specialists for dynamic segmental diagnostics of the functional state of the visceral systems of the body: 1) the palmar-medial segment goes along the palmar surface of the little finger to the skin projection of the flexor carpal ulnar tendon; it is used for DSD testing of cardiac activity; 2) the palmar-median goes from the middle finger to the skin projection of the palmaris longus tendon, used for DSD testing of vascular regulation; 3) the palmar-lateral goes from the thumb to the skin projection of the tendon of the brachioradialis muscle, is used for DSD testing of pulmonary function; 4) the manual dorsal-medial goes along the dorsum of the little finger to the skin projection of the ulnar extensor tendon of the wrist; it is used for DSD testing of the character of the small intestine peristalsis; 5) the manual dorsal-median goes from the III-IV fingers to the skin projection of the extensor tendon of the little finger, is used for DSD testing of the nature of general hormonal regulation; 6) the manual dorsal-lateral one goes from the index finger to the skin projection of the tendon of the longus muscle, which abducts the thumb, is used for DSD testing of the character of the motility of the large intestine; 7) the dorsal-medial leg extends from the first interdigital space to the anterior edge of the medial malleolus; it is used for DSD testing of the functional activity of the liver; 8) the leg dorsal-median goes from the second interdigital space to the projection of the long extensor tendon of the fingers in the flexion of the ankle joint, used for DSD testing of gastric smooth muscle tone; 9) leg dorsolateral goes from the fourth interdigital space to the anterior edge of the lateral ankle, is used for DSD testing of the smooth muscle tone of the gallbladder; 10) the medial foot runs along the medial edge of the foot from the big toe to the center of the medial ankle, used for DSD testing of the functional activity of the pancreas; 11) the posterior leg runs along the medial surface of the calcaneus from its lower edge to the posterior edge of the medial malleolus; it is used for DSD testing of the functional activity of the kidneys; 12) the lateral leg segment runs along the lateral edge of the foot from the little toe to the posterior edge of the lateral ankle is used for DSD testing of the smooth muscle tone of the bladder. used for DSD testing of functional activity of the kidneys; 12) the lateral leg segment runs along the lateral edge of the foot from the little toe to the posterior edge of the lateral ankle is used for DSD testing of the smooth muscle tone of the bladder. used for DSD testing of functional activity of the kidneys; 12) the lateral leg segment runs along the lateral edge of the foot from the little toe to the posterior edge of the lateral ankle is used for DSD testing of the smooth muscle tone of the bladder.

Discussion

Conjugation by segmental autonomic innervation of 12 pairs of skin

segments of vegetative supply with visceral systems of the body confirms the data on the segmental distribution of vegetative innervation during embryogenesis and makes it possible to introduce into medical practice such a concept as vegetotome. Vegetotome - a site of the embryonic anlage of the autonomic nervous system, which forms a single autonomic innervation of individual sections of the meso-, ento- and ectoderm. A part of the autonomic nervous system, formed in the process of embryogenesis from one vegetotome, provides autonomic support for a certain group of muscles, bones, blood vessels, specific visceral systems and skin areas with its epithelial structures, which become interconnected by a single segmental autonomic innervation. Based on the number of identified skin segments of the vegetative supply, it can be assumed that at least 12 vegetotomes are formed in the process of embryogenesis. The concept of "vegetative" cannot be equated with the concept of "neurotome", which is a part of the brain anlage corresponding to the place of origin of one pair of cranial or spinal nerves [7]. Vegetotomes and neurotomes, as derivatives of neuroectoderm, are morphologically and functionally connected, which provides reflex interaction between the structural elements of the body innervated by them. Unlike 12 vegetotomes, 40–42 neurotomes form the somatic innervation of individual somites and dermatomes, as parts of somites. Cutaneous segments of somatic innervation, called in some scientific works as dermatomes [8, 9], should be distinguished from cutaneous segments of vegetative supply, which, by analogy, can be called "cutaneous vegetotomes", although this name,

The coincidence of the localization of the skin segments of the vegetative supply with the localization of the outer passages of the classical meridians for the specialists of traditional oriental medicine is: firstly, an additional argument in disputes with representatives of Western medicine in favor of the interaction of the vegetative and meridian systems; secondly, it determines the functional significance and activity of acupuncture points from the nature of the vegetotrophic regulation of the corresponding KSVO; thirdly, it makes it possible to judge the state of the corresponding meridians by the nature of the vegetotrophic supply of individual “skin vegetotomes”.

From our point of view, the difficulties in establishing the boundaries of the skin segments of the autonomic supply above the fold lines of the wrist and ankle joints are caused by complex cross vegetative innervation. The laws of the formation of such innervation are possibly parallel to the laws of interaction of classical meridians, set forth in the theory of traditional oriental medicine.

conclusions

Dynamic segmental diagnostics represents a new generation in the class of technologies for studying the autonomic nervous system. This medical diagnostic technology helps to solve the fundamental problem of identifying systemic (morphological and functional) and

intersystem (neurosomatic - neurovegetative - meridian) organization of vegetative support. Dynamic segmental diagnostics makes it possible to determine the functional state of the main internal systems of the body, spinal nerves, the human meridian system, as well as to draw a conclusion about the nature of the vegetotrophic supply of individual areas of the skin.

Literature

1. Vegetative disorders: Clinical picture, treatment, diagnosis / Ed. A.M. Wayne. - M .: Medical Information Agency, 1998. - 752 p.

2. Boytsov I.V. Dynamic segmental diagnostics neurofunctional status of body systems // Reflexology. - 2005. - No. 4 (8). - S. 15-18.

3. Skoromets A.A., Skoromets A.P., Skoromets T.A. etc. Spinal angioneurology: a guide for doctors. - M., 2003 .-- 607 p.

4. Saturday V.V. Application of the method of dynamic segmental diagnostics spinal nerves (DSD-test) in the treatment of diseases of the spine // Physiotherapy and massage. Sports medicine. - 2008. - No. 9 (57). - S. 23–25.

5. Boytsov I.V. Method for the diagnosis of idiopathic arterial hypotension: A positive decision to issue a patent of the Republic of Belarus on application No. a 20101615 dated 12.11.2010. - Minsk: National Center for Intellectual Property, 2010. - 6 p.

6. Boytsov I.V. Method for diagnosing the motor-secretory function of the stomach: priority of the application for the grant of a patent for invention No. a 20110136 dated 03.02.2011. - Minsk: National Center for Intellectual Property, 2011. - 8 p.

7. Embryogenesis of systems of human organs: teaching aid on normal anatomy / Ed. P.G. Pivchenko. - Minsk: BSMU, 2007.

8. Ivanichev G.A. Sensory and reflex interactions in mechanisms acupuncture. - Kazan: Publishing house "Matbugat yorty", 1999. - 144 p.

9. Skoromets A.A., Skoromets A.P., Skoromets T.A. Topical diagnostics Diseases of the Nervous System: A Guide for Physicians. 5th ed., Stereotype. - SPb .: Polytechnic, 2007 .-- 399 p.

Author's address
Ph.D. Boytsov I.V.
Physician-reflexologist Spectral Dynamic Systems LLC
avicenna_h1@mail.ru

Boytsov, I.V. Dynamic segmental diagnostics (DSD-testing) / I.V. Boytsov // Traditional medicine. - 2011. - No. 2 (25). - P.19-25.

To favorites