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Abstract. Ultrathin sections of blood capillaries of the myocardium of the left ventricle of Wistar rats aged from birth to 45 days were studied. The obtained data made it possible to reveal some features of the postnatal development of the endothelium and blood capillaries in the myocardium of rats. In newborn rats, blood capillaries of the myocardium are formed by light and dark dehydrated endotheliocytes. The revealed heteromorphism of the endotheliocytes of the blood capillaries of juvenile rats indicates that they are at different stages of the cell cycle. Capillary loops, in the lumen of which there are clusters of erythrocytes, are found in the MRI of the myocardium of the left ventricle of 5-day-old rats. Under the pressure of protrusions of erythrocytes, intussusceptions of the cytoplasm of the endothelium deep into the interstitium are formed. Intussusceptions lengthen and gradually transform into new blood capillaries. In the myocardium of 15-day-old rat pups, morphological manifestations of the development of physiological apoptosis of blood capillary endotheliocytes and the formation of apoptotic bodies were revealed. Removal of apoptotic bodies from the lumen of the vessels of the MCR is carried out in two ways: passively – by blood flow, and actively – with the help of erythrocytes, which transport apoptotic bodies adsorbed on the surface along the bloodstream to the sinusoidal exchange capillaries and spaces of Disse of the liver. When studying the ultrastructure of the myocardium of rats of various ages, it was found that isolated and small groups of erythrocytes are observed outside the capillaries in the connective tissue. We assume that under physiological conditions, diapedesis of erythrocytes is due to oxygen deficiency in a limited area of the myocardium. There is deoxygenation of erythrocytes and an increase in oxygen content in the local area of connective tissue. The diapedesis of erythrocytes into the connective tissue of the myocardium prevents the development of hypoxia.

Key words: myocardium, capillaries, endothelium, diapedesis of erythrocytes.

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**PROCESSING OF STIMULUS ADDRESSED TO THE I AND II SIGNAL SYSTEMS AGAINST
THE BACKGROUND OF ACQUIRED MYOPIA**

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The main focus of the study is to investigate the correlation between myopia and immune disorders, as well as the peculiarities of stimulus processing in individuals with myopia. The research revealed that acquired moderate myopia is a pathophysiological process accompanied by immune disorders. The results showed that neurodynamic function indicators were better in individuals with myopia compared to practically healthy individuals, indicating functional strain on the central nervous system. The primary objective of the study was to examine the peculiarities of stimulus processing directed at the I and II signaling systems in the context of acquired myopia. Data on neurodynamic properties obtained through the M. Makarenko method were used for this purpose. It was found that information processing by the I signaling system occurs faster in individuals with myopia, which is related to the form of the

stimulus, specifically geometric figures. It was also determined that stimulus processing directed at the II signaling system is faster in individuals with myopia due to the use of simple words. The obtained results suggest the influence of stimulus training on the visual sensory system in individuals with myopia and provide opportunities for further research in the field of stimulus processing in the context of immune stimulation and prevention of acute respiratory infections. The conclusions of this study will contribute to the development of strategies for the prevention and treatment of myopia and enhance understanding of the mechanisms of the central nervous system functioning in individuals with myopia.

Key words: myopia, central nervous system, organ of vision.

The connection of the publication with planned research works.

Experimental research has an independent character.

Introduction.

Human in the modern sense is a social phenomenon, because he is a component of society. Any society consists of individuals who communicate with each other. During this process, there is an exchange of information and a change in emotional state. Modern society is information-cybernetic, which causes the perception of information from a close distance in the form of small symbols (numbers, icons, words), which leads to the formation of myopia as an adaptive reaction.

Such stress, from the point of view of physiology, is not infectious. This theory was well developed and substantiated by the Canadian scientist Selye in the 30s of the last century.

The information load on the visual analyzer is related to the social activity of a person in an industrial region. In modern society, a person perceives 80% of information through the organ of vision, which causes significant functional strain on the visual sensory system. According to the literature, the eye is a part of the brain that is outside the skull and is a peripheral part of the central nervous system [1, 2].

The functional load on the organ of vision is accompanied by morpho-functional changes in the structure of the eye, which are a manifestation of pathophysiological changes, which, in turn, causes changes in the activity of other body systems [3].

For the first time, it was established that myopia of an acquired form of medium degree as a pathophysiological process is accompanied by immune disorders of various degrees, and it was also found that indicators of neurodynamic functions in myopes are better than in practically healthy people, which indicates the functional stress of the central nervous system (CNS) [3, 2].

The aim of the study.

To study the features of processing stimuli addressed to I and II signal systems against the background of acquired myopia.

Object and research methods.

A group of volunteers participated in the study: I (control) are practically healthy people (80 men); II – people who suffered from acquired myopia of various degrees (70 men). Myopia was diagnosed by an ophthalmologist. At the time of the October-November study, all volunteers did not have chronic or acute diseases. The age of the volunteers was 24-30 years.

Taking into account changes in mental capacity at the beginning of the working day and week, research was carried out on days of high mental capacity – on Tuesday, Wednesday, Thursday from 09:00 to 11:00 in

the morning, when the optimal level of physiological functions is observed [4, 5].

To study the level of information processing addressed to I and II signaling systems, we used data on the state of neurodynamic properties. To obtain information about neurodynamic properties, we used the method of M. Makarenko. According to this technique, the latent periods of sensorimotor reactions of different complexity were studied: simple visual-sensorimotor reaction (SVSMR), reaction of choosing 1 of 3 stimuli (LPRC1-3), reaction of choosing 2 of 3 (LPRC2-3). Figures are used as a stimulus addressed to the I signaling system, and words are used as a stimulus addressed to the II signaling system. The functional mobility of nervous processes (FMNP) was determined by the highest rate of differentiation of positive and inhibitory stimuli with minimal exposure of their presentation in the «feedback» mode. This is the time it takes to complete the test. To avoid the subjective factor, testing of the state of neurodynamic properties was carried out three times, the best result was used for statistical processing.

The obtained data were subject to mathematical and statistical processing using STATISTICA 8.0 programs. For initial preparation of tables and intermediates Microsoft Excel 2010 package was used for calculations, with the help of which an analysis of the «normality of the sample» was carried out. For quantitative indicators calculated the arithmetic mean (M) and the standard error of the mean (m), for qualitative features – relative (B %) frequency.

The work was carried out in accordance with bioethical norms in compliance with the relevant principles of the Helsinki Declaration of Human Rights, the Council of Europe Convention on Human Rights and Biomedicine and the relevant laws of Ukraine. All volunteers gave written consent to participate in the research [6, 7].

Research results and their discussion.

A comparative analysis of research materials on the neurodynamic indicators of the body of volunteers of the control and experimental groups showed that the quantitative characteristics of the latent periods of sensorimotor reactions of different complexity had no reliable differences. It should be noted that the stability of latent periods of sensorimotor reactions of varying complexity is due to genetic determinism, that is, they change with age, namely, the older the body, the greater the value of the latent period. Our results characterizing the latent periods of sensorimotor reactions coincide with the data obtained earlier in the works of M. Makarenko, S. Lyzogub, and M. Makarchuk [8].

The indicators of the FMNP obtained in our study (**table**), which characterize the speed of information processing in practically healthy people, as for I and II signaling systems, coincide with the data obtained earlier in the works of M. V. Makarenko and S. V. Lyzogub [8].

Table – Indicators of neurodynamic functions during the processing of stimulus addressed to I and II signaling systems

Indicators	Practically healthy people (n=80) M±m		Myopic (n=70) M±m	
	figures	words	figures	words
SVSMR	2644,6	2703,1	256,71,8	277,43,2
LPRC ₁₋₃ ms	341,54,4	467,63,8	353,81,2	471,21,4
LPRC ₂₋₃ ms	389,93,5	5164,0	412,53,4	515,72,6
FMNP s	72,01.1	76,41,2	67,4±1,7*	72,51,1*

Note: * – reliability of changes in indicators between groups (P<0.05)

The processing of stimuli addressed to the I signal system (figure stimulus) in myopic people was better than in practically healthy people, as evidenced by the time of passing the test (**table**). The less time is spent on passing the type test, the faster information is processed. In our study, short-sighted people had 6% better FMNP (figure stimulus) compared to practically healthy people.

When processing the stimuli that were addressed to the II signal system (shape stimulus), we also obtained better indicators of the FRNP. Thus, in myopic people, the processing of stimuli addressed to the II signaling system was better by 5% compared to practically healthy people.

The processing of information by the signal system is somewhat faster, it is related to the shape of the stimulus, in our study it is geometric shapes that represent a simple symbol. That is, in this case, a separate symbol is processed, which carries minimal information, recognition and differentiation of a geometric figure.

In the II signal system, the processing of stimuli is slower, this is due to the form of the stimulus «word». A word, as a stimulus, consists of several symbols that combine to form a complex form of a «word image».

Thus, in myopic people, the processing of stimuli addressed to the I and II signaling systems occurs faster than in practically healthy people.

In the works of V. I. Sheiko and Y. I. Kolesnik [1, 2, 3, 9, 10] it was shown that in myopic people the general functional mobility of nervous processes was higher than in practically healthy people, but their work did not differentiate stimuli according to signaling systems. Our research is deeper and more precise. It should be noted that this is our first time a study was conducted, which is devoted to the processing of stimuli addressed to the I and II signal systems against the background of acquired myopia.

The results obtained by us can be explained as follows. Myopia is a manifestation of pathophysiological processes, as an adaptive reaction to a large flow of information perceived by the organ of vision, which is accompanied by changes in the indicators of the immune system, which, in turn, causes functional changes in the central nervous system. It is possible that the obtained changes in the HNA under conditions of myopia are a consequence of the training effect to the stimuli that are addressed to the visual sensory system (VSS). After all, we perceive 80% of information with our eyes. Similar changes in the indicators of the properties of neurodynamic functions were obtained in athletes of different classes by Professor I.O. Ivaniura and other scientists [11], who are involved in the processing of information received through the central nervous system.

Conclusions.

Thus, against the background of myopia, there is an improvement in the functional mobility of the nervous processes that underlie the processing of stimuli addressed to the I and II signal systems.

Prospects for further research.

The prospects of future research include the study of neurodynamic functions and the stimulus processing process addressed to the first and second signaling systems in the context of immunostimulation of the cellular, humoral, and nonspecific components of the systemic immune system in nearsighted and practically healthy individuals. Immunostimulation will serve as a preventive measure to prevent ARIs (Acute Respiratory Infections).

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ОБРОБКА ПОДРАЗНИКІВ АДРЕСОВАНИХ ДО I ТА II СИГНАЛЬНИХ СИСТЕМ НА ТЛІ НАБУТОЇ КОРОТКОЗОРОСТІ

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Резюме. У статті зазначено, що короткозорість набутої форми середнього ступеня як патофізіологічний процес супроводжується імунними порушеннями різного ступеня, а також встановлено, що показники нейродинамічних функцій у короткозорих кращі, ніж у практично здорових людей, що свідчить про функціональне напруження центральної нервової системи. Мета нашого дослідження – визначення особливостей обробки стимулів, адресованих I та II сигнальним системам, на тлі набутої короткозорості. Для вивчення рівня обробки інформації, адресованої I та II сигнальним системам, використовували дані про стан нейродинамічних властивостей. Для отримання інформації про нейродинамічні властивості використовували метод М. Макаренка.

У результаті дослідження було визначено, що обробка інформації I сигнальною системою у короткозорих відбувається дещо швидше, це пов'язано з формою подразника, в нашому дослідженні це геометричні фігури, які являють собою простий символ (коло, трикутник, квадрат). Тобто в даному випадку обробляється окремий символ, який несе мінімальну інформацію, відбувається розпізнавання та розрізнення геометричної фігури. Аналогічно швидшою у короткозорих людей є і обробка інформації адресованої до II сигнальної системи, через прості слова (словесні образи). Наприклад використовувалися прості слова, що склалися з одного складу: рис, сир, мак, тощо. Таким чином, у ході дослідження було встановлено, що у короткозорих людей обробка подразників, адресованих I та II сигнальним системам, відбувається швидше, ніж у практично здорових людей.

Ці результати можуть свідчити про те, що на міопію впливає тренуючий ефект подразників на зорову сенсорну систему, оскільки велика частина інформації сприймається очима. Подальші дослідження вбачаємо у дослідженні обробки подразників на фоні імуностимуляції та профілактичних заходів проти гострих респіраторних інфекцій.

Ключові слова: короткозорість, центральна нервова система, орган зору.

PROCESSING OF STIMULUS ADDRESSED TO THE I AND II SIGNAL SYSTEMS AGAINST THE BACKGROUND OF ACQUIRED MYOPIA

Streltsova V. V., Kuchmenko O. B.

Abstract. The article describes that myopia of an acquired form of medium degree as a pathophysiological process is accompanied by immune disorders of various degrees, and it is also established that the indicators of neurodynamic functions in myopes are better than in practically healthy people, which indicates the functional stress of the central nervous system. The purpose of our research is to study the features of stimulus processing addressed to the I and II signal systems against the background of acquired myopia. Data on the state of neurodynamic properties were used to study the level of information processing addressed to the I and II signal systems. To obtain information about neurodynamic properties, the method of M. Makarenko was used. As a result of the study, it was determined that the processing of information by the I signal system in myopes is somewhat faster, this is related to the shape of the stimulus, in our study it is geometric shapes that represent a simple symbol. That is, in this case, a separate symbol is processed, which carries minimal information, recognition and distinction of a geometric figure. Similarly, the processing of information addressed to the II signaling system through simple words (verbal images) is also faster in myopic people, but slower than in I signal system. Thus, in myopic people, the processing of stimuli addressed to the I and II signal systems occurs faster than in practically healthy people. These results suggest that myopia is affected by the training effect of stimuli on the visual sensory system, since much of the information is perceived by the eyes. Further studies may examine the processing of stimuli in the context of immunostimulation and preventive measures against acute respiratory infections.

Key words: myopia, central nervous system, organ of vision.

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