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INFORMATION-STRUCTURAL MODEL OF THE FORMATION OF STRESS-INDUCED SOMATIC DISORDERS THE CONSTITUTIONAL TYPES TAKING INTO ACCOUNT

Stress is a key factor that triggers a cascade of reactions of all links of the body's regulatory system, which ensures its adaptation to stress. The article provides an overview of different types of human constitution, which cause different mechanisms of formation of functional and organic disorders of organs and systems. Knowledge of these mechanisms is important for personalized management of conditions where stress is a provoking factor.

Key words: *Information-structural model, stress, hormones, regulatory system, immuno-neuroendocrine system, hypothalamic-pituitary-gonadal axis, hypothalamic-pituitary-thyroid axis, hypothalamic-pituitary-adrenal axis, types of constitution.*

Introduction

The tense socio-political situation related to the military actions of the aggressor on the territory of Ukraine caused the deterioration of the psychological, physical and social health of the citizens of our country. Chronic stress leads to exhaustion of the body's reserve capabilities, which leads to functional and organic disorders of organs and systems [1]. The triad "individual - personality - individuality" is decisive in the manifestation of psychosomatic biopsychosocial disorders in the chain reaction "tendency - personality - situation". The harmony of the relationship between an individual and society is essential, in particular in the aspect

of "friendship" or "hostility", since, in the first case, it makes it possible to avoid serious, and in the second case, on the contrary, to stimulate them [2]. Depending on the potential to which a person can withstand stressful situations and adapt to them, one can speak of stress resistance, which means the individual's ability to self-recover from the effects of stressful events.

It is worth to consider the phenomenon of stress resistance from the point of view of the individual's constitutional features, which are determined by a set of morphological, physiological and psychological characteristics inherited and acquired during life. Moreover, medical research [3, 4] indicates the relevance of studying individual stress resistance of

the entire population in order to identify people with a high risk of mental disorders, suicides, etc. Also, it concerns the problem of professional selection of military personnel, rescuers, firefighters, operators, and other professions associated with psycho-emotional and physical overstrain. The development of individual, constitutionally oriented programs for the timely identification of high-risk groups will enable to understand the basis of individual stress vulnerability, predict possible health disorders and develop effective personalized measures for the prevention and correction of post-stress disorders, taking into account the needs of this individual, and will also simplify the process of selection and distribution people who can perform various tasks more efficiently.

In our research, we will rely on studying the following phenomena: the constitution and age-related crisis periods; their influence on the formation of a state of stress resistance in the course of life; the development of an individual response scenario to the destructive effects of stressogenic factors [5]. In other words, it concerns psychosomatic, somatopsychic and somatoform disorders, as well as the role of a certain type of constitution in the development of this or that state in the aspect of age-related crisis periods.

The purpose of this work, which is the initial fragment of further research, is to create an individual constitutional profile using the integral method of a route map, which a priori indicates weak points in the constitution that may be primarily involved in the pathogenesis of stress-induced disorders.

Research tasks

1. To analyze the existing classifications of constitutional types (CT) with an emphasis on susceptibility to somatic, mental or functional disorders.
2. To determine CT resistance markers.
3. To develop approaches to determining the leading link in pathogenesis, which directs the development of the condition according to an algorithm determined by heredity and external factors (social status, migration to another climatic zone, etc.).
4. To analyze the existing WHO classification according to age from the point of view of age-related crisis periods

and to determine the dominant neuroendocrine axis for each age period.

The Existing Classifications of Constitutional Types Analyze

The interest in the phenomenon of the constitution has developed historically, because another phenomenon is connected with it - functionality, or in other words, the ability to carry out one or another job. In particular, it concerns professional selection. Physical parameters were taken as a basis - physique, which is determined by a set of external features: height, weight, degree of muscles development and subcutaneous fat layer, proportions of body parts. A harmoniously formed body was evidence of good health. Modern science has been able to connect the habitus (appearance, phenotype) of a person with the features of the regulatory or immuno-neuroendocrine system. The specificity of metabolic processes and endocrine reactions is the essence of the functional constitution. The concept of constitution is similar to the concept of phenotype. The constitution cannot be changed, as it is a genetically determined characteristic, but it can be corrected [6].

The optimal period of correction is the period of formation of the constitution. The actual somatic constitution, which is especially intensively formed in the period up to the age of 5-6 years, and the sexual and mental constitution, the formation of which mostly ends at the age of 12, are distinguished. It precisely corresponds the age periods of the formation of the neuroendocrine system, so it is worth taking into account the phenomenon of age-related crisis periods, which is determined by the periods of development of the neuroendocrine system. These crises belong to the normative processes necessary for the normal progressive process of personal development. According to E. Erikson, a person experiences eight psychosocial crises during his life, which are specific for each age period, and their favorable or unfavorable course determines the development of the personality in society (normal or abnormal line): crisis of trust — mistrust (the first year of life); autonomy - shame and doubts (two - three years); initiative — guilt

(three to six years); industriousness, diligence — an inferiority complex (seven to twelve years); personal self-determination, identification - individual grayness, conformism (twelve-eighteen years old); intimacy, sociability — isolation, self-reclusion (about twenty years); concern for the education of a new generation — "immersion in oneself" (thirty-sixty years); Ego integrity — despair (after sixty) [7]. Within the context of this concept, the formation of a personality is a change of stages in the qualitative transformation of the individual's inner world and his relationship with society, and the crisis of age development is a certain coordination of individual, biological factors with social factors. It is in moments of crisis that the struggle between positive and negative identity intensifies, which can cause an abnormal line of development.

Childhood crises have been thoroughly studied in psychology. The crisis of the first year of life, the crisis of 3 years, the crisis of 6-7 years, and the adolescent crisis of 10-12 years, which coincides with the periods of formation of the constitution, are usually distinguished (L.I. Bozhovich, L.S. Vygotskyi, T.B. Dragunova, D. B. Elkonin and others). For the action of stressogenic factors it is much faster to find its addressee precisely during the periods of endocrine restructuring of the body of a child or an adult. But according to which scenario the body's reaction will develop, depends on the peculiarities and weak links in the individual's constitution. In different age periods, one or another neuroendocrine axis has an advantage. In particular, at a young age, the hypothalamic-pituitary-thyroid axis is in the lead, in adulthood, the hypothalamic-pituitary-adrenal axis is dominant, and as we grow older, the hypothalamic-pituitary-gonadal axis changes. A person's appearance always carries information about the quantitative ratio of thyroid hormones and glucocorticoids in the body, as well as about the level and ratio of female and male sex steroids, that is, about the sexual constitution.

Today, there are more than a hundred different classifications, which are based on morphological (physiological), physiological, embryological, histological, neuropsychological or other criteria for assessing the characteristic features of a person. It

is worth to consider some of the most used classifications.

Researchers (G.L. Apanasenko, L.A. Popova) summarized the process of formation of psychosomatic constitutional belonging of a person. It is believed that the constitutional type (CT) depends on a number of factors: 1) the degree of disclosure of the potentials of germ leaves; 2) peculiarities of a person's endocrine status; 3) the genetically determined degree of development of various brain structures and the peculiarities of the formation of the mental constitution, etc. Let's analyze the main ones.

Even in ancient times, there were attempts to classify people according to their body structure, behavioral characteristics, susceptibility to certain diseases. Of interest is the classification of ancient Greek physician Hippocrates, who as early as the 4th century BC. e. initiated the doctrine of temperament and linked the peculiarities of people's physique with a predisposition to certain diseases. Based on empirical comparisons, he showed that short, stout people are prone to apoplexy, while tall and thin people are prone to tuberculosis. He studied not only physique, but above all their temperament. By temperament, Hippocrates understood both anatomical-physiological and individual-psychological features of a person. He associated the types of temperament with the predominance in the body of one of the "vital juices", namely blood, black bile, light bile and mucus, circulating in the human body. The predominance of yellow bile (chole, "bile, poison") makes a person impulsive, "hot" - choleric; lymph (phlegm, "sputum") - makes a person calm and slow - phlegmatic; of blood (sangvys, "blood") - makes a person mobile and cheerful - sanguine; black bile (melena chole, "black bile") - makes a person sad and timid - a melancholic. Later, (about 130 - 200 BC), the ancient Roman physician Claudius Galen also made an important contribution to the development of this theory, introducing the concept of habitus as a combination of morphological features characterizing a person's appearance.

The human typology, developed by the German psychopathologist E. Kretschmer (1888-1964), links the body type with certain mental characteris-

tics. In his research, he found that the type of body structure correlates with predispositions to certain mental illnesses. Thus, the maniacal-depressive character is most often distinguished for people with extremely pronounced picnic features, while athletics and asthenics, are prone to schizophrenic diseases. The first ones he called cyclothymics, the second - schizothymics. "The mental mood of each of both types of temperament," E. Kretschmer notes, "constantly oscillates between two other affective contrasts: in cyclothymics, - mainly between cheerfulness and sadness, in schizothymics - between heightened sensitivity and coldness." N.M. Obozov found that asthenics are generally more resistant to stress than picnickers. Picnickers have a weaker nervous system, asthenics have an average nervous system, and athletes often have a strong nervous system. People with an asthenic physique often have difficulties in social and interpersonal contacts. They have open and subjective thinking, and this requires extreme caution and attention when interacting with them [8].

The scientific basis of somatotyping was developed by professor of Harvard University William Sheldon (1898—1977). Following his system, all people are divided into endomorphs, mesomorphs and ectomorphs according to morphological characteristics. They got these names from the names of the three germ leaves. According to the components of temperament, they are divided into viscerosomato- and cerebrotonic. Endomorph (digestive type, viscerotonics) - a weak physique with an excess of adipose tissue. It is characterized by roundness, plumpness, the presence of a large belly, fat on the shoulders and hips, a round head, and underdeveloped muscles. An analogue of Kretschmer's Picnic.

Mesomorph (muscular type, somatotonics) - with broad shoulders and chest, strong arms and legs, massive head. An analogue of Kretschmer's Athletics.

Ectomorph (cerebral type, cerebrotonics) - with an elongated face, high forehead, long limbs, narrow chest and abdomen, lack of subcutaneous fat. An analogue of Asthenic according to Kretschmer. E. Kretschmer's character theory and N. R. Sheldon's temperament types are very similar. Endomorph is analogue of Picnic, Mesomorph is

analogue of Athletics, Ectomorph is analogue of Asthenic.

A person's physique has the ability to change during life, but somatotype does not, it is determined genetically and is a permanent characteristic. Age changes, certain diseases, and physical activity change the size and contours, but not the somatotype. The study of CT is important for medicine, because it makes it possible to prevent the strengthening of the body's weaknesses, to detect a predisposition to the disease, and in many cases to prevent its course, as well as to make the treatment individual. The main factor in determining body type is the thickness of the bone and wrist. Wrist circumference does not change with the amount of fat or muscle mass. The ectomorph has thin bones, the wrist is less than 17 cm. The mesomorph has medium bones, the wrist is from 17 to 20 cm, the endomorph is wide, the wrist is more than 20 cm. V.N. Shevkunenko and A. M. Geselevich (1926) identified three main variants of body types: dolichomorphic (narrow body, long limbs), mesomorphic (average values of both indices) and brachymorphic (broad body, short legs). This classification is still used today.

Popular is the classification based on the morphological principle, proposed by the French scientist D.R. Seago. He distinguishes the following constitutional types: respiratory (respiratory); digestive (digestive); muscular (cerebral).

The doctrine of the constitution of O. O. Bogomolets is of interest. Giving leading importance to the physiological system of connective tissue, he based his classification on the features of active mesenchyme: asthenic (thin, delicate connective tissue); fibrous (dense, fibrous connective tissue predominates); lipomatous (strongly developed adipose tissue); pasty (loose connective tissue predominates) [9].

Among clinicians, the classification of the scientist M.V. Chernorutsky, which is based on the morphological and functional features of the organism, is widespread. According to this classification, asthenic, hypersthenic and normosthenic people are distinguished. Asthenics, as a rule, have low blood pressure and absorption capacity of the intestines, increased metabolism. Hypersthenics are charac-

terized by high blood pressure, slowed metabolism, and a tendency to obesity.

Significance of Constitutional Types

Modern modifications of somatotyping, such as those ones given by V.P. Chtetsov or M.V. Chernorutskyi, which are traditionally used in medical practice, have been developed to indicate constitutional types. The main body coordinates are the dimensions of the body parts in 3 projections and the bone-muscle and fat coordinates. Proportions are expressed by ratios of sizes: longitudinal (length of the body, spine, limbs), transverse (shoulder and pelvic diameters), less often depth (anterior-posterior diameter of the chest of the pelvis, body dimensions; one of the longitudinal dimensions is taken as the basis. It can be thick asthenic/normosthenic or thin hypersthenic/normosthenic. Therefore, in our opinion, the determining coordinate in body assessment is body proportions. The most common and simple way to assess proportions is the index method. The degree of fat deposition and musculature development, as well as the shape of the chest, should be taken into account during constitutional diagnosis chest, abdomen and back. The signs of the structure of the face and head are not included in the scheme, because they are not signs of the constitutional, but of the racial order.

Using this scheme, the following three types are distinguished:

1. Asthenic type, which is distinguished by a slender body, higher than average height, weak development of the muscular system, predominance (compared to the normosthenic) of the length of the limbs over the length of the trunk; longitudinal dimensions of the body and dimensions of the chest above the dimensions of the abdomen; the substernal angle is sharp, correspondingly long lungs, the heart is small and elongated, low blood pressure, accelerated metabolism, increased function of the gonads, thyroid gland, pituitary gland, weakened function of the adrenal glands.

2. Hypersthenic type, as a rule, of medium height, larger cross-sectional dimensions of the body, strong stocky build, short limbs, well-developed chest, substernal angle - obtuse, high-placed

diaphragm, horizontal location of the heart, increased blood pressure, hypersecretion of the adrenal glands.

3. The normosthenic type, characterized by proportional body size and harmonious development of the musculoskeletal system, is an intermediate type between 1 and 2.

Body type can be determined:

- 1) according to the Pinieux index according to the formula: $L - (P + T)$, where L - body length (cm), P - body weight (kg), T - chest girth. If the Pinieux index is more than 30, then this constitutional type is asthenic (hyposthenic); if less than 10, then - hypersthenic; if from 10 to 30 - normosthenic.

- 2) according to the Solovyov index, when the length of the wrist girth is measured.

If the wrist circumference is less than 15 cm in women and less than 18 cm in men, then the constitutional type is asthenic (ectomorph); if from 15 to 17 cm in women and from 18 to 20 cm in men - normosthenic (mesomorph); if more than 17 cm in women and more than 20 cm in men - hypersthenic (endomorph). Such a classification covers a number of inherent functional features that are of interest in the stated context.

There are factor theories of typology, in particular Carl Gustav Jung is the author of the theory of introversion - extroversion. Based on psychological differences, he divided people into two general types, which he considered innate:

- introverted type. They are characterized by the fact that the value of the subject is always higher than the value of the object. His own opinion is more important to him than the surrounding reality or the opinion of other people;

- extroverted type. They are characterized by a focus on an external object, other people's opinions, generally accepted norms.

Trying to improve the theories of Kretschmer and Jung, the English psychologist Hans-Jurgen Eysenck proposed to consider the typologies of these scientists as a system of coordinates. Eysenck believed that there are two main factors of temperament:

- the "neuroticism" factor - a parameter according to which all individuals can be placed in a row, on one pole of which there is a personality type with extreme stability, maturity and a very good

By mental properties	According to Hippocrates	Sheldon's theory	Kretschmer's theory	The theory of K. G. Jung	The theory of Hans-Jürgen Eysenck
	Choleric	Viscerotonic	Penic (cyclothymic)	Introverted type	According to the "neuroticism" factor
	Phlegmatic	Somatotonic	Athletic (schizotymic)		
	Sanguine	Cerebrotonic person	Asthenic (schizotymic)	Extrovert type	According to the "extraversion-introversion" factor
	Melancholic		Dysplastic		
By physical properties	By body type	Sheldon's somatotyping	Morphological principle of Shigo	Bogomolets theory	Chernorutsky's classification
	Anthropometric data	Endomorphs	Respiratory CT	Asthenic	Asthenics
	Weight	Mesomorphs	Digestive CT	Fibrous	Hypersthenics
	The degree of muscles development	Ectomorph	Muscle CT	Lipomatous Pasty	Normostenics

Fig. Structured methods of determining the constitutional types of a person

ability to adapt, and on the other - an extremely nervous unstable and poorly adapted type;

- the "extraversion-introversion" factor is bipolar. It is characterized by a high degree of positive saturation in the case of extroverts and a high degree of negative saturation in the case of introverts. Based on the description of the behavior of extroverts and introverts, on the one hand, and individuals with high or low neuroticism, on the other hand, Eysenck built his model of temperament types. Hans Eysenck equates the combination of emotional stability with extraversion with the sanguine type, neuroticism with extraversion with the choleric type, introversion with neuroticism with the melancholic type, introversion and emotional stability with the phlegmatic type.

Construction an Information-structural Model of the Formation of Stress-induced Somatic Disorders

Below, an attempt to structure the analyzed information has been made with the aim of creating an

informational structural model of the formation of post-induction somatic disorders, taking into account constitutional types, which will allow determining the predisposition to certain diseases (Fig.).

It is worth noting that it is practically difficult to single out "pure" types of constitution. Traits of different types are usually combined in a person, so the vast majority of people have a mixed typology. Typing is important for clinical practice, as it determines the features of the body's reactivity and susceptibility to certain diseases, diatheses, and idiosyncrasies.

Conclusions

Analysis of the most widely used classifications of constitutional types was carried out according to various characteristics, which is necessary for solving the problems of our further work, which aims to determine the stress resistance of a person depending on CT.

Basing on the analysis, a number of CT resistance markers relevant in the context of the given

task were selected, namely: 1. Determination of somatotype based on anthropometric measurements, where the marker is the determination of body proportions in their ratios; 2. Determination of phenotypic parameters, where the marker is body weight; 3. Collection of personal and family history, which indicates genetic predisposition to certain conditions and reactivity of the body; 4. Definition of the age period, the corresponding dominant neuroendocrine axis and the phenomenon of age crisis. 5. Determination of neurobiological characteristics of an individual by scales.

All the listed factors are the basis that determines the individual principles of stress resistance. They are the basis of the route map for determining the individual constitutional profile, which a priori indicates weak points in the constitution that may be primarily involved in the pathogenesis of stress-induced disorders.

The next stage of the work is planned to conduct a pilot study of the contingent of workers in terms of age and gender for the presence of functional and organic disorders of organs and systems in relation to the type of their constitution, as well as the

selection of the most effective methods of assessing these conditions.

For this, somatotyping will be carried out; determination of biological age; a number of questionnaires and scales will be used, in particular: anamnestic questionnaire; H. Eysenck's test for determining the type of temperament; H. Eysenck's method of self-assessment of mental states; Holmes and Raghe's method of determining stress resistance and social adaptation, which is useful in the diagnosis of psychosomatic diseases; Boston test for stress resistance; short scale of anxiety, depression and post-traumatic stress disorder (PTSD); structured clinical interview CAPS-5 to establish the diagnosis of PTSD and determine the degree of functional impairment; Hospital Anxiety and Depression Scale (HADS); PHQ-15 health questionnaire. Assessing the stress resistance of individuals in relation to the features of various types of human constitution will allow to understand the mechanisms of formation of functional and organic disorders of organs and systems, the knowledge of which is important for the personalized management of conditions where stress is a provoking factor.

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ІНФОРМАЦІЙНО-СТРУКТУРНА МОДЕЛЬ ФОРМУВАННЯ СТРЕС-ІНДУКОВАНИХ СОМАТИЧНИХ РОЗЛАДІВ З УРАХУВАННЯМ КОНСТИТУЦІЙНИХ ТИПІВ

Вступ. Напружена соціально-політична ситуація, пов'язана з воєнними діями агресора на території України, спричинила погіршення психологічного, фізичного та соціального здоров'я громадян нашої держави. Хронічний стрес зумовлює виснаження резервних можливостей організму, що призводить до функціональних та органічних порушень органів та систем. Тріада «індивід – особистість – індивідуальність» є визначальною в маніфестації психосоматичних біопсихосоціальних порушень у ланцюговій реакції «схильність – особистість – ситуація». Суттєвим є гармонійність взаємозв'язку індивіда із соціумом, зокрема в аспекті «дружність» чи «ворожість», оскільки, в першому випадку, це дає можливість уникнути серйозних порушень, а в іншому - навпаки, спонукати до них. Залежно від того, наскільки людина може протистояти стресовим ситуаціям та адаптуватися до них, говорять про стресостійкість, що означає здатність особистості до самовідновлення від впливу стресових подій.

Метою даної роботи, яка є початком дослідження в цій галузі, є створення за інтегральною методикою маршрутною карти визначення індивідуального конституційного профілю, який априорі вказує на слабкі місця в конституції, що можуть бути першочергово задіяні в патогенезі стрес-індукованих розладів.

Результати. Стрес є ключовим чинником, що запускає каскад реакцій усіх ланок регуляторної системи організму, що забезпечує його адаптацію до стресу. В статті наводяться механізми формування функціональних та органічних порушень органів та систем в залежності від особливостей різних типів конституції людини. Знання цих механізмів є важливим для персоніфікованого керування станами, де стрес є провокуючим фактором.

Висновки. На основі проведеного аналізу виділено ряд опорних маркерів конституційних типів, актуальних в контексті поставленої задачі, а саме:

1. Визначення соматотипу за даними антропометричних вимірювань, де маркером є визначення пропорцій тіла у їх співвідношеннях;
2. Визначення фенотипічних параметрів, де маркером є вага тіла;
3. Збір персонального і сімейного анамнеза, що вказує на генетичну схильність до певних станів та реактивність організму;
4. Визначення вікового періоду, відповідної йому домінуючої нейроендокринної вісі та феномену вікової кризи.
5. Визначення нейробиологічних особливостей індивіда за шкалами.

Всі перераховані фактори є підґрунтям, яке визначає індивідуальні засади стресостійкості. Вони і є основою маршрутною карти для визначення індивідуального конституційного профілю, який априорі вказує на слабкі місця в конституції, що можуть бути першочергово задіяні в патогенезі стрес-індукованих розладів.

Подальші дослідження. Наступним етапом роботи планується проведення пілотного дослідження контингенту працівників у віковому та гендерному аспекті на наявність функціональних та органічних порушень органів та систем у взаємозв'язку з типом їх конституції, а також відбір найбільш ефективних методик оцінки цих станів.

Ключові слова: стрес, гормони, регуляторна система, імунонейроендокринна система, гіпоталамо-гіпофізарно-гонадна вісь, гіпоталамо-гіпофізарно-тіреоїдна вісь, гіпоталамо-гіпофізарно-наднирникова вісь, типи конституції.