UDC 351.814.2 (043.2)

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INFORMATION STRESS FACTORS AND DIAGNOSIS TECHNICS FOR AIR TRAFFIC CONTROLLERS

The features of the information stress and the factors that cause them are considered. Biochemical and physiological markers for stress determination are studied.

Stress is often considered as a particular functional state and at the same time as a psycho-physiological reaction of organism to environmental influences that go beyond the boundary of adaptive rules.

The term "stress" was created by Hans Selye in 1929. Originally, Selye used the term "stress" to describe the totality of all non-specific changes (inside the organism), functional or organic. One of his last definitions of stress is that "non-specific reaction of the organism to any demand from the outside" (Selye, 1974) [4].

Thus, in general, stress is a nonspecific component of adaptation, which plays a catalytic role to attract energy and plastic resources for adaptive alteration of the organism.

The stimulus that causes the stress reaction is called a stressor. Due to the features of the stimulus, there are at least two versions of stress: physical (physiological, with one signal) and psycho-emotional (with two signals).

The problem of stability and reliability of the human operator in the conditions of extreme factors and the development of psychological distress has attracted a great attention and gained some shapes as an independent area of research due to the development of technology, automatic control systems, and especially the computerization of all spheres of activity [3].

The operator’s profession in the system of air traffic control (ATC) is characterized by high psychological-emotional and intellectual orientation, and is one of the most stressful and emotionally intense types of professional activities. The operator's performance and its ability to carry out the work on time and accurately depends not only on the capacity of the air traffic control system, and the safety in general.

Activities of ATC operator is associated with the periodic, sometimes quite long and intense exposure of (or the expectation of exposure) the extreme values of professional, social, and environmental factors. This exposure is accompanied by negative emotions, overstrain of physical and mental functions and activity degradation. Psychological stress is the most characteristic mental state, developing under the influence of ATC factors.

Development of stress in the extreme conditions of operator’s activity can be also connected with the possibility, expectation, the threat of exposure of various stimuli of physico-chemical, psychological (personal), organizational and professional nature on ATC operator. On this basis, this condition can be regarded as a typical form of professional stress. On the other hand, the features of the regulatory mechanisms of this mental state can be referred to the category of psychological stress.

These studies show that in the conditions of influence of the extreme values of information professional factors on the ATC operator the changes in biochemical reactions, a number of physiological functions and some psycho physiological parameters specific for the effects of physical and chemical stressors and which are non-specific adaptive response of the organism were observed.

Non-specific adaptation processes under the extreme exposure of information factors allow us to consider the development of mental state as an information stress of ATC operator.

This kind of stress can be defined as a state of increased mental stress, with symptoms of

functional somatic and mental disintegration, negative emotional experiences and performance disturbance resulting from adverse effects of factors of information interoperability of specialist in his professional activity.

Information stress - is a state of ATC operator that is the result of information overload, when he cannot cope with the task, has no time for correct decisions in the required tempo with a high degree of responsibility for the consequences of decisions.

The most common factors causing stress of the information content in the process of professional activity of ATC are:

- Semantic - a) lack of information, b) contradictory information, c) the subjective complexity of the problem, d) low subjective probability of information entry and perception, e) the subjective information risk, f) the redundancy of information, g) the subjective complexity of the problem, h) subjective uncertainty of the presented information, etc.

- Temporal - a) lack of time, b) a high rate of information presentation, c) arrhythmy of the information presentation, d) the uncertainty of the received signal time (unexpectedness), e) increasing information flow, and f) increasing rate of the information presentation, etc.

- Organizational - a) a low probability of an objective presentation of information, b) the objective uncertainty of the moment of information presentation, c) wrong choice of necessary information, d) attention distraction, e) signal omission, f) combined activity, g) the objective complexity of the problem, h) an objective danger of the situation, etc.

- Technical - a) the refusal of the information system, b) interferences in networks, c) signal lock, d) signal shutdown, e) information distortion, f) false information, g) signals interference, h) a contradiction of information signs of the situation, i) insufficient graphic structuring of information, j) mismatch of signal information characteristics etc [2].

How does the information stress express? It is known that the manifestation of the response reactions on the psychological stress can arise depending on the functional system of response and processes that form the behavior of the individual organism during the interaction with the environment.

The difficulty of stress determination has the ambiguity of understanding. Considering the literature definitions of stress, it is assumed that the term stress is not determined by the reaction, but a state of homeostasis, providing the necessary human activity in certain environmental conditions. Stress response is the change of activity level under the influence of various stressors [1].

Biology has progressed in this field greatly, elucidating complex biochemical mechanisms that appear to underlie diverse aspects of stress, shining a necessary light on its clinical relevance and significance.

Despite this, science still runs into the problem of not being able to settle or agree on conceptual and operational definitions of stress. Because stress is ultimately perceived as a subjective experience, it follows that its definition perhaps ought to remain fluid. For a concept so ambiguous and difficult to define, stress nevertheless plays an obvious and predominant role in the everyday lives of humans and nature alike.

There have been many attempts to identify the most sensitive indicators (markers) of psychological stress both biochemical and physiological one. It is noted that the sharp changes occur in the individuals whose level of these constants was higher or lower than the rest. Although the biochemical and physiological indicators of emotional stress reaction are individually very variable, however, we select some of them, with a help of which it will be possible to determine the stress on ATC operator.

The indicators (markers) of heart rate and galvanic skin reflex are the most informative. These two indicators of emotional stress experience the impact of the basic components of emotional reaction (need intensity and prognostic efficiency estimation directed for its satisfaction).

As for the biochemical markers, we can use hemoglobin level of bilirubin and glucose in the blood of ATC operator.

During the stress the hormones (cortisol, epinephrine) come into the blood which rapidly

exceeds the level of glucose due to its release from the liver (liver is a place of glucose storage in a modified state - glycogen). This phenomenon is a protective reaction of the organism. As the glucose is the main source of energy, it provides a high level of the body's ability to respond the external stimulus. Consequently, even at the slightest stress a significant hyperglycemia can be observed. When the stress passes, the glucose level returns to normal.

Information stress causes marked reduction of the affinity of hemoglobin for oxygen in the blood, which in turn increases the oxygen tension in hepatocytes and activates free-radical processes in the liver microcosms. Therefore, the hemoglobin level reduces, and at long-term effects of stress level of bilirubin increase.

Laboratory tests of blood, built on invasive techniques are associated with patients traumatizing, the possibility of infection, as well as a fairly lengthy procedure of obtaining a diagnostic result. Therefore, to diagnose the state of air traffic controller it is preferable to use non-invasive methods for determining blood parameters that are superior to laboratory efficiency, effectiveness and economy.

Therefore, a combined non-invasive electro-optical device hemobiliglyukometr (HBG-1) was developed for the diagnosis of adverse effects and stress on the operator's body. It incorporates new approaches to the processing and correlation of the received information, as well as ergonomic design was developed [6].

Non-invasive measurement of blood parameters such as bilirubin, hemoglobin and glucose in combination with psycho-physiological tests will allow to fully characterize the state of the air traffic controller and depending on the received load improve the efficiency of their operation.

The study of information stress problem in the activity of ATC operators related with the need to clarify the role of various information factors in the formation of the state of stress and mental mechanisms of regulation of this state, the value of personal psychological characteristics in its development, individual susceptibility and the resistance to the stress factors effects, etc.

Identification of psychological patterns of information security activities of the ATC operators, psycho-physiological processes of regulation of labor activity in its interaction with the means of information display and control, and the development of principles and guidelines of reliability support should be the subject of productive researches.

The study of the causes of information stress and mechanisms of their formation will help to reduce their impact on the ATC's body, thereby enhancing his professional reliability.

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