

# The Technology of Objective Diagnosis, Treatment and Prevention of PTSD in Members of the Armed Forces under Conditions of Hybrid War

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**Abstract. Objectives:** To develop the technology of objective diagnosis, treatment and prevention of PTSD in hybrid war syndrome. Conduct a pilot study of searching potential biological markers for PTSD. **Methods:** We systematized data on different syndromes based on the methods of induction and deduction, comparative system analysis and analogies: Vietnam War Syndrome, Afghan War Syndrome, Chechen Syndrome, Persian Gulf Syndrome. The authors also investigated the conditions of occurrence and described the mechanisms of formation the hybrid war syndrome. As an important part of developing and realisation the technology of objective diagnosis, treatment and prevention of PTSD we conducted ophthalmological study, aimed to find objective biological markers of PTSD. **Results:** We have developed a version of the technology of objective diagnosis, treatment and prevention of PTSD in hybrid war syndrome. The pilot study of ophthalmological PTSD markers have shown specific peculiarities in ocular physiology (eye movements, accommodation, convergence and pupil size) in persons with PTSD distinguished from the ones in healthy persons. A kind of correlation of the eye tracker data with the polygraph data has been established. Detailed data of biological ophthalmological markers we plan to present in our subsequent articles. **Conclusions:** The technology of objective diagnosis, treatment and prevention of PTSD in hybrid war syndrome is proposed. The technology is based on a comprehensive psychological and physical examination. It includes: 1. Establishment of possible etiological factors affecting the PTSD formation in hybrid war syndrome. 2. Detection. Comprehensive assessment and diagnostic algorithms (objective medical diagnostic procedures, objective latent control system for psychological assessment). The pilot study of ophthalmological objective PTSD markers have shown specific peculiarities in ocular physiology in persons with PTSD distinguished from the ones in healthy persons. 3. Differential treatment approach, which is based on various therapy strategies depending on the established etiological factors. 4. Prevention. "Supportive" techniques, based on "Individual chart" creation in order to identify possible risks, to track the dynamics in physiological and mental sphere before, during and after being in hybrid war.

**Keywords** - the hybrid war, PTSD, biological (ophthalmological) markers of PTSD, eye movements.

## I. INTRODUCTION

War accompanied mankind throughout its existence. Herewith, world history shows a clear trend of

increasing their number. Thus, for example, over a period of 15 years - from the end of the 19th century until the First World War (1914–1918), 36 wars and military conflicts were recorded (2.4 wars per year). In a hundred years for the same period, 100 (10 conflicts per year) were recorded [1]. Mental disorders caused by traumatic events and stressful situations are called post-traumatic stress disorder (PTSD). From one crisis situation to the next, the syndromes become more complex, more multifaceted, multisymptomatic, and multisystem. Such symptoms in several other manifestations also occur in non-combatants who are in the combat zone. Moreover, similar syndromes occur in many subjects who are located in the zone of any crisis situations (zones of modern military (armed) conflicts, man-made or natural disasters, places where terrorist acts took place, etc.).

Therefore, a study of the causes, characteristics of the development of crisis situations in general and specific crisis situations is relevant and important. The Vietnam War has become a powerful motivation for research by American psychiatrists, psychologists and other specialists [2]. Although the terms PTSD and "syndromes of ... wars" in Vietnam (1965–1975), in Afghanistan (1979–1989) and Chechnya (Ichkeria) (1994–1996) are considered almost identical, the essence of their formation and the characteristics of the manifestations led to their differentiation as independent syndromes which has specific features and differences [3].

Despite a fairly large number of various publications on issues related to crisis situations syndromes, their symptoms and manifestations, the problems of system analysis of a variety of factors influencing their formation, identifying the underlying causes of their occurrence and the objectivity of their detection and diagnosis remain open and require their study.

Known algorithms for the PTSD diagnostics are semi-quantitative or qualitative, in most of the cases they are built of questionnaires and interviews [4], [5], [6]. The subjectivity of such methods compels them to rely on researcher's mastery and degree of testee involvement.

Currently the lack of diagnostic biomarkers for PTSD is not due to a lack of intensive study, which is likely to be

caused by the complexity of PTSD and the complex set of rules by which we classify individuals according to the 5<sup>th</sup> edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) [7]. There are review articles on biological PTSD markers in 2013 and 2015 [8], [9].

Although ophthalmic markers are absent in these articles we can find solitary works on this topic.

## II. OBJECTIVE

To develop the technology of objective diagnosis, treatment and prevention of PTSD in hybrid war syndrome. Conduct a pilot study of searching potential biological markers for PTSD.

## III. MATERIALS AND METHODS

We systematized data on different syndromes based on the methods of induction and deduction, comparative system analysis and analogies: Vietnam War Syndrome, Afghan War Syndrome, Chechen Syndrome, Persian Gulf Syndrome. The authors also investigated the conditions of occurrence and described the mechanisms of formation of the hybrid war syndrome.

As an important part of developing and realisation of the technology of objective diagnosis, treatment and prevention of PTSD we conducted an ophthalmological study, aimed to find objective biological markers of PTSD.

The pilot ophthalmological studies were provided by SI "Filatov Institute of eye disease and tissue therapy NAMS". The ophthalmological markers of PTSD were studied in two groups of volunteers. The main group (22 persons) which patients already have proven diagnosis PTSD, and control group (24 persons) – healthy volunteers. We estimated features of eye movements recorded via eye tracker, also matched eye tracker data with polygraph data. On contrary to the majority of works in this field which rely on visual stimulation, we used verbal stimuli – a dialogue with a psychiatrist. We also assessed pupil reactions, degree of accommodation and convergence and stereoscopic threshold.

The study protocol was approved by a local institutional review board and is in compliance with the Helsinki Declaration. A signed informed consent was obtained from all subjects. Studies were conducted through the use of eye tracker and lie detector. During the subject were undergoing the questionnaire for combat PTSD the measures of eye tracker and lie detector were registering simultaneously.

The following specialists were involved in the investigation: eye tracker operator, polygraph examiner, ophthalmologist and psychiatrist.

The research was carried out in the room with definite requirements. It was isolated from disturbing factors and was comfortable for a test-taker subject. During the

examination there were four people present in the room: psychiatrist, eye tracker operator, polygraph examiner and a test-taker subject. Another room was suited for ophthalmologist. The nearest convergence point and the nearest point of clear vision (test BERNELLb) were established for assessment of corresponding parameters. Pupils diameters were examined by Bernell OCCLUDE-A-MEASURE BC/7019. The stereoscopic threshold was tested via STEREO FLY TEST (STEREO OPTICAL CO., INC., Vectogram, Chicago) and via LANG STEREOTEST II (Lang – Stereotest PO.Box 19 CH-8127 Forch)

Another equipment used in the research included eye tracker (GP3HD 150Hz), polygraph (Lafayette LX 4000), monitor, notebooks.

Main group: males, 27 to 45 y.o., soldiers and sergeants of Ground Forces of the Armed Forces of Ukraine, who directly participated in military actions on the frontline. They had already been diagnosed with PTSD, had no somatic complaints, denied traumatic brain injury, other psychiatric or neurologic disorders.

Control group: males, 23 to 31 y.o., soldiers, sergeants and junior commanding staff of Ground Forces of the Armed Forces of Ukraine, almost healthy somatically, had never taken action on the frontline and had no diagnosed psychiatric or neurologic diseases.

Participants placement in the room: a test-taker subject sits on a chair and faces the monitor which is placed on a table 50 cm away from eyes of a patient. The eye tracker is mounted below the monitor. There is an eye tracker operator to the right of a test-taker subject following the process with a notebook. To the left of a test-taker subject there is a polygraph examiner who dynamically analyzes the data from polygraph via notebook. At the opposite side of the table and to the left of the polygraph operator there is the psychiatrist who instructs a testee and reads verbal stimulating material.

The verbal stimulating material is a test for PTSD diagnostics that is included in the supplement to the order of the Ministry of Health of Ukraine №121 from 23.02.2016 "The unified clinical protocol of primary, secondary (specialized) and tertiary (highly specialized) medical help. Stress reaction and adaptation disorders. Post-traumatic stress disorder" and is recommended to physicians of all specialties for PTSD screening.

## IV. RESULTS

Studies have shown that the emergence and formation of crisis syndromes depends on a large number of various factors, conditions and circumstances. We have studied, summarized and systematized all these factors. The first generalizing factor in the development of syndromes was the time and place where the crisis situation occurred, of course, with its geographical and territorial features, features of the population living in the territory, etc. Secondly, the nature of

the crisis situation influenced the formation of syndromes. For example, the nature of war (type and intensity of conflict, characteristics of the enemy, armament and military equipment (AME), conflict outcomes). Thirdly, the formation of syndromes is significantly influenced by social, demographic and other characteristics of the personnel, their awareness, education, training, motivation, etc. Fourthly, the person's damage causes and nature (combat physical trauma, combat mental trauma, friendly fire, informational influence, etc.). In the fifth, manifestation symptoms of syndromes (PTSD, chronic multisymptomatic disease (CMD) etc.).

On the one hand, there is a partial community of formation and manifestations of various syndromes (Vietnamese, Afghan, Chechen, Persian Gulf, etc.), and on the other hand there is some difference in the factors underlying the formation and symptomatology of these syndromes, as well as in their manifestations. The concept of "Crisis Situation Syndrome" was defined, which allows generalizing them and at the same time emphasizing the difference between them. "Crisis situations syndrome" (wars, military conflicts, man-made, natural disasters, terrorist acts, etc.) is status that manifest as a complex of specific mental, psychosomatic and physiological changes. It occurs in a large number of subjects who underwent a combination of traumatic effects of different nature and complex information-psychological effects in a certain time in the same events, processes, actions.

A special case of crisis syndrome is the hybrid war syndrome.

We have developed a version of the technology of objective diagnosis, treatment and prevention of PTSD in hybrid war syndrome. It includes:

1. Establishment of possible etiological factors affecting the PTSD formation in hybrid war syndrome.

Factors differentiation:

- by time factor: acute or chronic stress (shock stress / accumulated stress)
- by the physical / mental / informational component of the influence (conventional / non-conventional influence)
- by the presence of precede factors. The presence / absence of education and the specific and particular educational features, prior social phobias.
- according to the personal degree of responsibility and stress intensity in a crisis situation
- by working with innovative tools and devices

2. Detection.

Comprehensive assessment and diagnostic algorithms (objective medical diagnostic procedures, objective latent control system for psychological assessment [10]).

The pilot study of ophthalmological PTSD markers have shown specific peculiarities in ocular physiology (eye

movements, accommodation, convergence and pupil size) in persons with PTSD distinguished from the ones in healthy persons. A kind of correlation of the eye tracker data with the polygraph data has been established. Detailed data of biological ophthalmological markers we plan to present in our subsequent articles.

3. Differential treatment approach, which is based on various therapy strategies depending on the established etiological factors.

4. Prevention. "Support" techniques development at all stages of being in crisis situation.

"Individual chart" creation in order to identify possible risks, to track the dynamics in physiological and mental sphere before, during and after being in hybrid war.

"Individual chart" includes two groups of studies:

1. Conjoint ophthalmological-psychological examination includes conducting psychological testing/interview simultaneously with eye tracker. As far as possible to combine this examinations with the polygraph examination.
2. Ophthalmological examination includes accommodation, convergence, dark adaptation, visual fields, eye blood circulation and electroretinography assessment. Special focus on these surveys should be made in subjects who manipulate electronic display devices and/or night-vision devices. This study gives opportunity to give individual recommendations on the time and frequency of electronic display devices and/or night-vision devices usage, to perform preventive control and correction.

Creating the "Individual baseline chart" must be made at the time of admission to a specialized military structure.

Second stage of examination: must be made at special training period that simulates combat conditions (the formation of "vaccinations" from PTSD). Obtained data should be compared with data of "Individual baseline chart".

Further examinations must be carried out every 3 months in a zone of a hybrid war or immediately after specific events. Obtained data should be compared with data of "Individual baseline chart". In case of detecting certain PTSD markers during the examination subject must be refer to a specialized institution for further examination and therapy.

## V. DISCUSSION

In the process of formation and development of crisis situations syndromes special role belongs to informational and psychological factors (informational and psychological influence, propaganda and counter-propaganda, native and enemy work of strategic communications, public image for the events, a welfare safety net and comfort). But the informational components are fundamental an common in

formation these syndromes. The growth of society informatization increases the degree of both general and targeted destructive informative influence on subjects of crisis situations. It strengthens and aggravates PTSD, and in some cases is one of the main reasons for its emergence and formation.

Changes in the nature and characteristics of modern wars have a significant impact on the aetiology of crisis situations syndromes [11], [12]. First of all, this refers to the features, means and methods of warfare [13].

A hybrid war that is de jure going on the territory of Ukraine, and de facto covers more and more participants around the world [14] in its content, forms and methods of conducting can be considered as a specific variant of the implementation of fourth-generation warfare (4GW) - according to the western classification [15]. In general, in hybrid conflicts of any intensity, battle actions (operations) are an element of mutually agreed upon unified plan (non-force) actions of mainly economic, political, diplomatic, information, psychological, cybernetic, cognitive, etc. [12, 16.] This creates destabilizing internal and external processes in the country (popular frustration and anxiety, migration, civil disobedience actions, etc.). Hybrid wars, firstly, are not declared and, secondly, therefore, cannot be completed within the meaning of the end of wars and military conflicts. This is a kind of permanent war of variable intensity in various areas with chain reactions of interaction, launch and synergistic manifestations of destructive manifestations. The entire population of the country and the international community are consciously or unconsciously involved in this type of war [16]. The influence spread all over spheres of life, all social strata, and throughout the territory. Due to the innovative technologies usage, it became possible to move from actions of a general destructive nature to actions with a predominantly functional and structural impact on the enemy, and most importantly, attaining a cognitive advantage over enemy.

All this became the determining factors forming the hybrid war syndrome, in which practically the entire territory of the country is a zone of active destructive actions of different nature and character. The consequences of a hybrid war (conflict) are not limited by casualty rate and destructions. It also includes the consequences impact on the cognitive sphere of community at large. At the moment, both combatants and civilians (who are reside at the hybrid conflict zone) have a presentation of a number of psychological and behavioural peculiarities that can be characterized as “hybrid war syndrome”. In the formation of a “hybrid war syndrome”, the place and time of a crisis situation acquire their own characteristics depending on where conventional or non-conventional actions are conducted, with the prevailing role of informational, psychological and cognitive influence on participants.

Thus, the hybrid war (hybrid conflict) syndrome is a condition manifested as a complex of characteristic mental, psychosomatic, physiological and cognitive changes that

occur to varying degrees in the population of countries involved in a hybrid conflict, subjected to a combination of traumatic influences of various nature and a complex of informational and psychological and cognitive influences, having individual and group manifestations.

The detection of people with a high risk of prolonged emotional “scars” development after an exposition to certain traumatizing event with subsequent usage of such info for PTSD prevention is being a subject of great interest [17]. The review article from 2013 mentions the following biomarkers for PTSD diagnostics: hypothalamic-pituitary-adrenal system dysregulation, sympathetic adrenomedullar system hyperreactivity, intensification of quadruplet bodies reflexes, cognitive distortions, “anatomic” markers such as reduction of amygdala, anterior cingulate cortex, prefrontal cortex, hippocampus. Authors emphasize quadruplet bodies reflex as the most reliable biomarker [8]. In addition to the foresaid, the review article from 2015 expands the data on neuroendocrine disorders and also mentions serotonergic system disruption, inflammatory biomarkers (some interleukins, C-protein, TNF), psychophysiological markers which estimate a vegetative nervous system responses (heart rate, blood pressure, skin conduction, respiratory rate, body temperature, muscular contractions) [9].

The close relationship of informational and cognitive influence on the development of PTSD in hybrid war syndrome suggesting neurobiology and neurophysiology as application points for its diagnostics. There are multiple brain-eye connections, some authors consider an eye as “a brain on a periphery”. For instance, an activation of amigdala, which is responsible for primitive emotions, leads to pupil dilatation. Eye movement abnormalities are observed in various somatic and psychosomatic conditions, furthermore allow assessing cognitive functions. In our opinion, an eye may serve as a “gateway” to the brain’s physiology in PTSD.

Considering the clinical and biological complexity of PTSD there is a minor to no chance of single biomarker identification. Prognostically, multiple biomarkers will be used as PTSD manifestation attribute, risk assessment factors or objective signs of recovery [18].

There are few researches on eye tracking in war veterans. The majority of them rely on visual stimuli whereas we used verbal stimuli – a dialogue with a psychiatrist. One research linked PTSD to vigilance on contrary to believed avoidance. Authors also determined midriasis in PTSD patients [19]. Another research reviewed a model of vigilance-avoidance. Authors stated an attention shift to a possible threat which was accompanied by specific vegetative excitation. At this scenario there is no avoidance of upcoming threatening stimulus [20]. The mentioned papers focus on vigilance-avoidance mechanism studying and present major interest for psychosciences. Our work is accentuated on possible biomarkers detection. We studied the basic functions of the visual analyzer (saccades, pupil reactions, degree of accommodation and convergence and stereoscopic threshold).

The complex of specific ophthalmic data we received provides a great perspective in terms of PTSD diagnostics since multiple biomarkers may be revealed.

In the very near future proposed technology of objective diagnosis, treatment and prevention of PTSD, may be of great economic interest. It allows hasten and objectivate diagnostic process in a large number of members of armed forces with minimal expense. It provides an opportunity for PTSD prevention and well-timed detection with the participation of only a few specialists (as the main specialist psychologist / psychiatrist, and as an expert in identifying objective biomarkers - an ophthalmologist).

## VI. CONCLUSIONS

The technology of objective diagnosis, treatment and prevention of PTSD in hybrid war syndrome is proposed. The technology is based on a comprehensive psychological and physical examination. It includes: 1. Establishment of possible etiological factors affecting the PTSD formation in hybrid war syndrome. 2. Detection. Comprehensive assessment and diagnostic algorithms (objective medical diagnostic procedures, objective latent control system for psychological assessment). The pilot study of ophthalmological objective PTSD markers have shown specific peculiarities in ocular physiology in persons with PTSD distinguished from the ones in healthy persons. 3. Differential treatment approach, which is based on various therapy strategies depending on the established etiological factors. 4. Prevention. "Supportive" techniques, based on "Individual chart" creation in order to identify possible risks, to track the dynamics in physiological and mental sphere before, during and after being in hybrid war.

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