

THE FACTORS OF FORMATION OF PSYCHIC DISORDERS OF COMBATANTS WITH DAMAGES OF LOCOMOTOR SYSTEM

Sergey A. Lytaev

Military Medical Academy, St.Petersburg, Russia

ABSTRACT

The analysis of modern local conflicts shows that 50-75 % casualties are injuries of the locomotor system. Surgical treatment of their patients is a different topic of discussion. At least two groups of factors evoke psychic changes in injured:

Wound disease is a state of combatant and is accompanied by varying as to its extension and depth, damage to the integrity of human structures, with local, segmentary and system disorders, with a change and disturbance of the body functioning, sharp increase of entropy, hypoxia and energy deficiency, with compensatory processes transient, unstable at first and prolonged, relatively stable later. After somatic clinical recovery the wound disease persists for a long time in the form of posttraumatic stress disorders.

Traumatic disease is a state of combatant with damages of locomotor system and is accompanied by disorders of metabolic processes.

It is possible to form a third group apart from the others - amputation syndrom and psychic changes connected with it.

From the point of view of psycho-physiological correction for the purpose of early rehabilitation and recovery it is desirable the adequate diagnosis of the leading pathogenic mechanisms of wound and traumatic diseases. They are secure inhibition, distribution of blood circulation (brain and extremities), selective transform of energy for physiological functions, selective activation of afferent and efferent flows of motor activity.

The analysis of conceptions of psychological reactions in participants of extreme situations (ES) in the last 30-40 years allowed us to establish the following principles [1-5, 7-9, 12, 14, 15, 20, 21] (Table 1).

Table 1
Chronology of medico-psychological conceptions of ES
(the analysis of literary data)

Years	Conceptions
1952-1968	(DSM I) Gross stress reaction
1968-1980	(DSM II) Transient situational disturbance
70-th	Emotional shocking syndrome
70-80-th	The stress-related emotional lability syndrome
	Traumatic disease
	Post-traumatic stress disorder in Vietnam veterans
1980	Post-traumatic stress disorder (PTSD)
1987	(DSM-III-R) – PTSD
80-90-th	Post-traumatic stress disorder in Afghanistan and Chechnia veterans
	Wound disease

As a rule combatants attend psychologist with formation of actual psychic disorders, or many years later after psychotraumas [1,2,17]. In early periods after combat actions in case of absence of actual psychic symptoms or other dangerous pathology (for example, surgical), the psychological support is provided rarely.

The problem of preventive estimate of the basic and more complex forms of the psychic activity of combatants is significantly increased, because the analysis of modern local conflicts shows that 50-75 % casualties have injuries of the locomotor system [17].

What is the basic psychic functions? The comparative character and hierarchic relationship between the types of psychic activity are shown in Table 2 [18]. The perception with its subjective character (the sensation) is practically the base for all other forms of psyche. Thus, sensory processes are the base for other psychic phenomena. Furthermore, the cycle of sleep-activity, the memory, emotions and motivations are also basic mechanisms having their dimensions.

The estimate of mechanisms of somatosensory and visual (invariant image recognition, brief-storage memory) perception in combatants with battle injuries of the locomotor system for study of genesis present (and future) of psychic disorders and creating of the adequate rehabilitation programs was the purpose of this investigations.

Table 2
The basic forms of psychic activity and their brief characteristics
(V.Shostack & S.Lytaev, 1999)

Character of psychic activity	The forms of psychic activity			
	Perception (vi-sual, somatosen-sory etc.)	Cycle of sleep-activity	The Memory	Emotion and motivation
Forms of appearance	The sensation	Sensation & all forms of perception, language, voluntary activity, EEG-parameters	All forms of reproduction of information	All forms of activity (mental, physical, vegetative)
The characteristic	Depends on modality of signals and of sensory system (contrast, colour, tone, etc.)	Levels of sleep & activity	Forms of memory sensory, brief-, long storage	Depends on levels of activity of systems of organism
Dimension	Depends on modality of signals and of sensory system	Depends on forms of sensations & EEG-parameters	Volum - bit, bait; periods, hours, years	Ball, sten
The base for other forms of psychic activity	For all other forms	Attention, language, mentality, consciousness	Learning, language, mentality	Behaviour, temperament

METHODS

72 young adult subjects (male: from 20 to 34 years) with battle injuries of locomotor system were examined. On the basis of the findings of treatment of wounded in Afghanistan (1978-1988) and Chechnia (1994-1996) military campaigns all the casualties of the last campaign (1999-2000) were divided in four groups.

Wounded with multiple trauma (n=7) present the most severe group. Although the number of multiple wounds were varied from 5 to 12 %, poor results of treatment with invalidity up to 80 % were registered from this category of patients.

The second group - wounded (n=24) with soft tissue injuries (~50 %). The period of return to the standing army was till 30 days. Provided by special treatment casualties with fractures of plane and some long bones, damage of tendons could be returned to the standing army from 90 to 120 days. The cases with periphery nerves injuries (from this group, n=22) are presented below.

The other two groups - the casualties with multiple and single fractures of long bones (n=41).

The surgical treatment with external or internal osteosynthesis were performed for all patients at the period from few days to 1,5-2 months after injures depending on various reasons.

In the Military Traumatology and Orthopedics Clinic brain evoked potentials (EPs) and ultrasonic dopplerography (USDG) from vessels of the upper and lower extremities were recorded.

The recording of cognitive event-related brain potentials (ERPs) has had a rich history in the psychological investigations [6,11,13,16,19]. In our examinations ERPs were recorded with computer neuromapper "brain surveyor" in the 19th monopolar sites by system 10/20. Visual and electrical stimulation were applied. The amplitude-temporary parameters and successive cerebral maps were estimated by changing the analyzed epoch at intervals of 10-400 (or 1000) ms, and stepwise discriminant analysis (BMDP 7M) was performed (according to criteria of F statistics, $F > 4,0$).

Somatosensory EPs (SEPs) were recorded by electrical stimulation of periphery (damaged and normal) nerves for diagnostic purposes. The epoch of analysis - 400 ms.

Visual EPs (VEPs) with images as stimuli (ERPs) were recorded for estimate of cognitive processes - invariant evolution of signals and primary memory [10]. The epoch of analysis - 1000 ms. Nine images with incomplete set of signs, consisting of familiar objects - key, spectacles, anchor, balance, nippers, scissors, tea-kettle, electric lamp and trumpet - were presented to examinees under conditions of time deficit (exposition of 10 ms).

RESULTS AND DISCUSSION

In a gunshot wound even without damage of large vessels the development of the typical disorders of blood flow and the hypoxia of tissue take place, forming the "devil" cycle (named as the traumatic disease (TD)) [17]. The TD provokes the activation of katabolism and cyclic changes of periphery blood flow.

The analysis of USDG data permitted us to establish that shaft fractures of long bones were accompanied with one of possible mechanisms of indirect reactions of vessels. After the fracture of traumatic etiology the secure mechanism of blood flow reduction in the damaged extremity was provoked, and, by contrast, it increased in normal extremity. The gunshot fractures evoke mechanism of reduction of blood flow in the both lower extremities, when secure reflex of centralisation of blood flow developed.

The dynamic instability of blood flow provide important significance in the modulation of functions of somatosensory systems (motor, pain, temperature etc.). According to this early changes of bases psychic function - of the perception are provoked. These changes are not registered only from periphery nervous system, but and from central regions of nervous system - ponto-geniculo-thalamo-cortical projections.

The results of registration of SEPs and successive brain maps permitted us to establish, that complete damage of nervous fibers (plexus or tracts of spinal cord) are manifested by absence of signals (SEPs) in cortex. Uncomplete damage of this structures is characterized by "partial" response. At the same time SEPs can be absent in the projectional (parietal) cortex, however, be evoked in the associational (frontal) region of the brain. The registered parameters

from the periphery nerve of intact extremity can not be controlled, because the parameters are changed by afferent flows on the nervous plexus from the damaged nerve. The threshold of activity of the damaged nerve can be reduced or increased. It depends on the character and period of the damage.

These investigations mainly were performed in wounded with posttraumatic neuropathy of periphery nerves (N=22) for diagnostic purposes. Further, the tasks for SEPs registration were extended. The results of this series of experiments suggest that not only complete anatomic damage of nerve provokes changes in somatosensory processes. Thus, the patterning of blood flow disorders during TD, and also the common state of the patients (according to wound disease, see below) can greatly influence on the somatosensory system.

The possibility that battle injuries of locomotor system might influence somatosensory transmission at the most periphery and central levels suggest that other sensory systems and forms of psychic activity demand investigation also. Accepting to the attention this task we studied mechanisms of invariant recognition of visual images and brief-storage memory by means registration ERPs in casualties.

It was noticed that in the studies of the fragment visual image perception the indication of informativity of an irritant had already begun at the stage of analyzed period (to 100 ms). It is proved by the changings of the amplitude-time characteristics of ERPs N70 and N150, reflecting the early and intermediate mechanisms of selected attention. The absence of recognition (more than 60 % of wounded) is characterized by decrease of amplitude of ERPs component N150 in the assotational cortex and general reduction N350. This data we suppose from position of reduction of force inter- and intra- hemispheric interactions provided of memory functions. However, it is accompanied by increase of amplitude of more late waves ERPs. Wave N450 is the most specialized indicator of unidentified visual images perception. The latest negative waves (600-1000 ms) reflect the further processes of the image categorization, that can pass either in inertion, representing the cyclicity and similarity with early and intermediate stages of perception or actively reflect the reverberation of stimulation.

The results of ERPs registration allowed us to speak about two possible mechanisms of activation of the long storage memory. The first of them is characterized by inhibition of frontal cortex in the period of synthesis of informational flows (100-200 ms) with sequential activation of occipital and parietal cortex (200-500 ms). This processes probably provided mechanism of "unlogic" mentality. The second variant of memory activation on the early (to 100 ms) and medial (100-200 ms) periods of perception was connected with activation of the frontal region of the brain with sequential general irritation by mechanisms of "exhaustive search". The use of this paradigm was additionally motivated by the findings in the aging literature [13,16,19] and our results accord to data of others scientists [6,10,19].

Furthermore, psychic and emotional disorders were determined by wound disease (WD). WD is a state of the combatant. It is accompanied by varying as to its extention and depth damage to the integrity of human structures, with local, segmentary and systemic disorders, with a change and disturbance of the body functioning, sharp increase of entropy, hypoxia and energy deficiency, with compensatory processes transient, unstable at first and prolonged, relatively stable, later [17]. After somatic clinical recovery the WD persists for a long time as a form of PTSD.

CONCLUSION

From the position of psychophysiological correction for the purpose of early rehabilitation and recovery the adequate diagnosis of the leading pathogenic mechanisms of wound and traumatic diseases is desirable. They are secure inhibition (Pavlovian law of force), distribution of blood circulation (brain and extremities), selective transforming of energy for physiological functions, selective activation of afferent and efferent flows of motor activity. The state of psyche needs to be estimated from the position of all forms (from multiple reflex activity to any forms of consciousness). Specific and nonspecific disorders of sensory function in wounded with battle injuries of the locomotor system are presented. Nonspecific disorders likely characterize all the combatants, are the factors of PTSD and demand psychological support.

REFERENCES

1. Atkinson R.M., Spar L.F., Sheff A.G. et al. (1984) Diagnosis of posttraumatic stress disorder in Vietnam veterans: preliminary findings. *Amer.J.Psychiat.*, 141, 694-696.
2. Baskett S.J., Henager J. (1983) Differentiating between post-Vietnam syndrome and preexisting psychiatric disorders. *South Med.J.*, 76, 988-990.
3. Davidson I.R.T., Foa E.B. (1991) Diagnostic issues in posttraumatic stress disorder: considerations for the DSM-IV. *J.Abnorm.Psychol.*, 100, 346-355.
4. Davis G.C. Breslau N. (1994) Posttraumatic stress disorder in victims of civilian trauma and criminal violence. *Psychiat.Clin.N.Amer.*, 17, 289-299.
5. Escobar J.I., Canino G., Rubio-Stipec M., Bravo M. (1992) Somatic symptoms after a natural disaster: a prospective study. *Amer.J.Psychiat.*, 149, 965-967.
6. Friedman D. (1990) Cognitive event-related potential components during continuous recognition memory for pictures// *Psychophysiology*, 27, 136-148.
7. Gersons B.P., Carlier I.V. (1992) Posttraumatic stress disorder: the history of a recent concept. *Br.J.Psychiat.*, 161, 742-748.
8. Green B.L., Lindy J.D. (1994) Post-traumatic stress disorder in victims of disaster. *Psychiat.Clin.N.Amer.*, 17, 301-309.
9. Horowitz M.J., Wilner N., Kaltreid N., Alvarez W. (1980) Signs and symptoms of PTSD. *Arch.Gen.Psychiat.*, 37, 85-92.
10. Lytaev S., Shevchenko S. (1997) VEPs and AEPs mapping of occlusive lesions in cerebral vessels. *Annals New York Acad.Sci. NY: NY Acad. Press*, 821, 524-528.
11. Lytaev S.A., Shostack V.I. (1994) The image classification from mapping of visual evoked potentials. *Human Physiology*, 20 (1), 13-21.
12. McDaniel E.G. (1988) Psychological response to disasters. In P.Baskett, R.Weller (Eds.), *Medicine for Disasters*. London, Boston: Wriht, 231-245.
13. Noldy-Cullum N.E., Stelmack R.M. (1987) Recognition memory for pictures and words: the effect of incidental and intentional learning on N400. In R.Johnson, J.W.Rohrbaugh, R.Parasuraman (Eds.), *Current research in event-related potentials. EEG & Clin.Neurophysiol.*, Suppl.40. Amsterdam: Elsevier, 350-354.
14. Pary R., Lippmann S.B., Turns D.M. et al. (1988) Post-traumatic stress disorder in Vietnam veterans. *Amer.Fam.Physician.*, 37, 145-150.
15. Poinso Y., Mouren M.C. (1976) Les syndromes post-emotionnels. *Ann.Med.Psychol.*, 134, 185-218.
16. Rugg M., Furda J., Lorist M. (1988) The effects of task on the modulation of event-related potentials by word repetition. *Psychophysiology*, 25, 55-63.
17. Shapovalov V.M., Erochov A.N., Lytaev S.A. (1997) The rehabilitation from disease, traumas, and injuries of the locomotor system. In Y.N.Shanin (Ed.) *Medical Rehabilitation of the Wound and Sick.- St.Petersburg: Special Literatura*, 631-661 (in Russ).
18. Shostack V.I., Lytaev S.A. (1999) *The Physiology of Psychic Activity*. St.Petersburg: Dean (in Russ).
19. Smith M.E., Halgren E. (1989) Dissociation of recognition memory components following temporal lobe lesions. *J.Exp. Psychol. Learning, Memory and Cognition*, 15, 50-60.
20. Spitzer R.L., Williams I.B., Gibbon M., First M. (1989) *Instruction Manual for the structured clinical interview for DSM-III-R*. New York: State Psychiatric Institute.
21. Wetzels M.H. (1977) The stress-related emotional lability syndrome. *Acta Psychiat.Belg.*, 77, 267-283.