Chernobyl Shelter personnel; 6) Highly technological methods of neuroimaging (fMRI, PET) are exclusively important for neuropsychiatric diagnostic following exposure to ionizing radiation, however, they demand significant resources of health care.

Conclusion**:** It is crucial to develop and realize the National system for mental health care for the survivors of radiation accidents and radiological terroristic attack. This system has to be based on neuropsychiatric and psychophysiological approaches to provide the complex psychiatric–psychological, neurological, and narcological aid. The biopsychosocial paradigm is most reasonable for mental health care of survivors of radiation accidents and radiological terroristic attack. International studies are of a great importance according to the challenges of modern society.

doi:10.1016/j.ijpsycho.2010.06.281

Psychophysiological, neuroimmune and gene expression changes in chronic fatigue syndrome after low-dose radiation exposure

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Background: Dysregulation of the cortical hemispheric controls of immunological functional systems (left hemisphere) and hypothalamic-pituitary-adrenocortical axis is the underlying pathophysiology of Chronic Fatigue Syndrome (CFS). Quantitative EEG analysis would appear to be a promising diagnostic indicator for this disorder (P. Flor-Henry et al., 2010). The Chronic Fatigue Syndrome (CFS) is currently considered to be the conventional cluster of characteristic symptoms, resulting from the exposure to low levels of different exogenous hazards, including ionizing radiation, viral infections etc. The classical examples of "environmental CFS" were described following the Gulf War and the Chernobyl accident.

Objectives: The goal was to detect the changes of brain electrical activity, neurocognitive and immune functions and gene-expression following exposure to low levels of radiation and non-radiation industrial hazards as a result of the Object "Shelter" transformation to an ecologically safe system.

Methods: Brain mapping of quantitative electroencephalography (qEEG), cognitive functions assessment (RAVLT), immunologic phenotype, carriage of blood infections (CMV, HSV, HCV, HBV, *Toxoplasma gondii*) and with individual external, internal, and total radiation doses assessment for 90 "Shelter" workers (males aged 36–52 years) at the baseline and after exposure were used. TP53, TP53 I3, BIRC 5, DDB 2, NF-kappa B, TGFR, MKNK2, CDKN1B, CDKN2A, CCND1, CDKN1A, FASLG, MADD, BAX, and MAPK14 gene expression was performed in 12 workers.

Results: The doses for 1–4-year periods consisted of: external—0–69.9 mSv (M ± SD: 20.4 ± 13.7), internal—0–2.4 mSv (0.4 ± 0.5), total—0–70.6 mSv (19.4 ± 13.9). Following the works the mild cognitive disorder and abnormal EEG increased; verbal short-term memory, verbal learning, and proactive interference of verbal information deteriorated; delta-, theta- and beta-power increased in the left fronto-temporal region together with alpha-power and dominating frequency of electrical brain activity decreasing. These data, at a dose-related manner, testified to low doses related to overactivation of the cortical-limbic system mainly in the dominant (left) hemisphere. Gene studies have demonstrated increased BRIC5 (survivin) and MKNK2 expression possibly of protective origin together with the individual variation of the other genes expression, the moderate cellular-type immune system deficiency and absence of the viral blood infections reactivation.

Conclusion: The cognitive subtype of CFS is characteristic for those exposed to low doses of ionizing radiation. Its neurophysiological basis seems to be an overactivation of the cortical–limbic system mainly in the dominant (left) hemisphere. Performed study shows some connection between the nervous and immune system changes and absence of relationship with the chronic viral infections carriage that is reported in CFS patients. Gene expression study revealed mainly the activation of protective systems and it was not possible to find out the "molecular signature" of the low doses of ionizing radiation, possibly due to the influence of concomitant factors. Expansion of the study and organization of international collaboration on CFS following low dose exposure seems be promising.

doi:10.1016/j.ijpsycho.2010.06.282

Psychophysiological peculiarities of post-traumatic stress disorder after the chernobyl accident

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Background: Post-traumatic stress disorder (PTSD) is considered to be one of the most significant mental health problems following the Chernobyl accident (April 26, 1986). However, the psychopathological and neurophysiological features of PTSD following the radioecological disaster are unknown.

The objective of the study is to reveal the psychophysiological peculiarities of PTSD following the Chernobyl accident.

Subject and methods: PTSD was diagnosed according to the DSM-IV criteria in 47 clean-up workers (liquidators) of the Chernobyl accident (age [M ± SD] 54.3 ± 0.9 years; radiation doses ranged 0.03–4.5 Gy, M ± SD 0.4 ± 0.01 Gy), 21 evacuees from the Chernobyl exclusion zone in 1986 (49.9 ± 6.1 years); and 28 veterans of the Afghanistan war (48.6 ± 6.4 years). Controls included 26 healthy males (50.0 ± 6.4 years). We used clinical neuropsychiatric examination, neurometry (EDSS), psychometry (BPRS, MMPI, IES, IES-R, IDA, Mississippi Scale, GHQ-28, SDS, Spielberg–Khanin Anxiety Scale), neuropsychological assessment (RAVLT, SKT), ultrasound dopplerography with duplex scans of the blood vessels in the neck and head, 16-channels quantitative EEG (qEEG), scale for risk factors assessment, dosimetric data, and statistics.

Results: PTSD in Chernobyl accident survivors, in contrast to veterans of war, is characterized with projection of fear and apprehensions to the future (anticipatory stress): concerning cancer, congenital abnormalities in off-spring etc. PTSD following radiation exposure has a significantly higher rate of comorbidity with neuropsychiatric disorders, mainly cerebrovascular. Liquidators and evacuees have significantly higher ($p < 0.002$–0.001) levels of psychopathology assessed by BPRS (14.9 ± 3.6 and 15.3 ± 3.1 scores, correspondingly) than veterans (12.2 ± 3.0) and norms (1.5 ± 1.5). Chernobyl accident survivors with PTSD characterized by higher level of neurological abnormalities, cognitive dysfunction, personality disharmony, anxiety, responsiveness, somatoform symptoms, insomnia, depression, and social dysfunction than combat veterans with PTSD. The cerebral haemodynamics of liquidators with PTSD showed the highest levels of atherosclerosis of *arteria carotis commonis,* especially, right. Liquidators, in comparison with evacuees, have lower speed of blood flow in *a. cerebri media dexter, a. cerebri anterior sinister,* and *a. vertebralis (V4) dexter.* Chernobyl accident survivors, in comparison with combat veterans, showed worse haemodynamics in vertebro-basillar basin. Brain bioelectrical activity of Chernobyl accident survivors, particularly in evacuees with PTSD, differed from