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Editorial

Sleep and armed conflict: future complications of war in Ukraine

For more than five months now, Russian troops have been destroying cities in Ukraine. A large part of Ukraine is under attack 24 hours a day by missiles, artillery and aircraft, and in some places, there are street battles. This war can affect the psychological state of all people, both military and civilian persons who are in Ukraine, as well as citizens outside of Ukraine because physical and moral exhaustion has become an urgent problem for people.

A human reaction to a stressful event depends significantly on the functioning of the circadian system, which prevents the fundamental foundations of the body's adaptation to environmental changes. At the same time, the stress response system itself has a basic circadian activity. Over the past two years, the demands of social isolation associated with the COVID-19 pandemic have created a new way of life for people on the Earth that exacerbates the misalignment between internal and social circadian cycles and can lead to desynchronization with higher sensitivity to stress and vulnerability to stress-related disorders [1].

The problem of sleep during the war is rarely addressed in modern research because it is falsely considered to be of insufficient importance. At the same time, the war in Ukraine demonstrates the importance of this topic and the need for thorough research in this field. In particular, not only changes in the quality and architecture of sleep among veterans, but also in the civilian population, are an urgent issue.

It is a well-known fact that war causes stress-related mental disorders, including post-traumatic stress disorder and adjustment disorders, which may be associated with sleep disturbances. However, it is worth taking into account that poor sleep quality can act as an additional stress factor and can play a role in the progression of neurological diseases. An affected population is a heterogeneous group with different backgrounds, medical histories, experiences, and coping strategies. However, the armed conflict determines three cohorts for research on sleep disturbances related to the war, such as veterans, refugees, and civilians.

The most studied cohort of victims of military conflicts is veterans and combatants. Being under constant shelling from the enemy, traumatic damage to the nervous system, long-term stress, and field living conditions lead to the development of sleep disorders, which are considered a link between post-traumatic stress disorder and combat exposure [2]. It has been found short sleep duration, poor sleep efficiency, long sleep onset latency, poor sleep quality, higher frequency of insomnia symptoms, and nightmares are significantly above in Iraq/Afghanistan veterans than in the general population. The poorer sleep quality in this population was also associated with more severe psychiatric disorders [3]. At the same time, the study of Gulf War veterans has demonstrated the association between lower subjective sleep quality with reduced total cortical and regional frontal lobe volume independent of psychiatric comorbidity [4].

Refugees' sleep can be disrupted eiither as a consequence of integration in the host country, including lifestyle changes such as diet and working hours, or due to mental health disorders associated with war. It has been shown that in refugees, unlike migrants, sleep disturbances are more correlated with psychiatric symptoms than psychosocial problems [5]. A study of internally displaced persons after the Russian invasion of Crimea and east of Ukraine in 2014 shows the dominance of the structure of anxiety symptoms and depressive symptoms against the background of adjustment disorders [6]. However, the research on the neurological consequences of disturbed sleep in refugees from war-torn regions is currently insufficient.

The consequences of war for the civilian population in the armed conflict remain the least studied. Every day, civilian Ukrainians are exposed to the fear of danger, which threatens their lives, and numerous air warning signals, the number of which can reach 30 per day. It is clear that in such conditions the quality of sleep and circadian rhythmicity cannot remain at a satisfactory level, which in turn directly affects the state of the entire body.

Sleep and circadian rhythm disorders have a significant impact on the nervous system. Our body adapts to the rhythmic fluctuations of the environment and foresees periods of sleep and activity, which is unfortunately difficult or even impossible in the conditions of war. Thus, in the state of an armed conflict, people may be subject to loss of sleep, deterioration of its quality, frequent awakenings, and irregu-

larity of the circadian rhythm. Experimental studies have indicated that sleep loss can increase inflammatory markers and affect metabolic processes that play an important role in the development of many diseases of the nervous system [7].

The disruption of circadian regulation caused by the war in Ukraine may increase the number of paroxysmal conditions among the population. It is well known that sleep deprivation can trigger epileptic seizures, and epilepsy has a bidirectional relationship with sleep phases and patterns [8]. Equally important is evidence of a close relationship between sleep disorders and headaches, such as migraine, tension-type headache, cluster headache, and hypnic headache [9,10].

The key role of sleep in the immunological regulation of the nervous system is well reflected in 1 case-control study, which demonstrates that sleep disturbance might be a trigger for an acute MS exacerbation [11]. On the other hand, the suppression of neurogenesis and the strengthening of the development of neurodegenerative diseases as a result of chronic sleep restriction, which causes circadian and neuronal disorders, are emphasized [12,13].

Sleep is often seen as a necessary component of the memory consolidation process. Appropriate integration of information received during the day occurs during the phase of slow sleep, the deficit of which can be observed with frequent awakenings [14]. Therefore, we can assume an increase in the frequency of cognitive disorders against the background of military conflict.

And the most obvious, but nevertheless significant consequence of sleep disorders occured against the war in Ukraine can be an imbalance of neurotransmitters, which can lead to the development or increase in the severity of affective disorders, for example depression [15].

Based on preliminary evidence, we can expect an increase in mental and neurological disorders among both veterans and the civilian population, which will create an additional burden on the health care system. We have demonstrated the likelihood of an increase in sleep and circadian rhythm disorders, which can increase the manifestations of mood disorders and stress-related disorders, increase the frequency of paroxysmal states, and increase the risk of developing neurodegenerative and demyelinating diseases. Thus, we draw attention to the fact that the war in Ukraine will have inevitable consequences on the health of the nervous system. We believe that this is an issue that should be addressed now to identify the prevalence of sleep and circadian rhythm disorders, as well as to prevent the consequences for the nervous system.

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REFERENCES

[1] Boiko DI, Skrypnikov AM, Shkodina AD, Hasan MM, Ashraf GM, Rahman MH. Circadian rhythm disorder and anxiety as mental health complications in post-COVID-19. Environ Sci Pollut Res 2022. http://dx.doi.org/10.1007/s11356-021-18384-4.

[2] Osgood JM, Finan PH, Hinman SJ, So CJ, Quartana PJ. Combat exposure, post-traumatic stress symptoms, and health-related behaviors: the role of sleep continuity and duration. Sleep 2019;42. http://dx.doi.org/10.1093/sleep/zsy257.

[3] Ulmer CS, Van Voorhees E, Germain AE, Voils CI, Beckham JC. A comparison of sleep difficulties among Iraq/Afghanistan theater veterans with and without mental health diagnoses. J Clin Sleep Med 2015;11:995–1005. http://dx.doi.org/10.5664/jcsm.5012.

[4] Chao LL, Mohlenhoff BS, Weiner MW, Neylan TC. Associations between subjective sleep quality and brain volume in Gulf war veterans. Sleep 2014;37:445–52. http://dx.doi.org/10.5665/sleep.3472.

[5] Richter K, Baumgärtner L, Niklewski G, Peter L, Köck M, Kellner S, et al. Sleep disorders in migrants and refugees: a systematic review with implications for personalized medical approach. EPMA J 2020;11:251–60. http://dx.doi.org/10.1007/s13167-020-00205-2.

[6] Herasymenko LO, Isakov RI, Halchenko AV, Kydon PV. Clinical features of adjustment disorder in internally displaced women. Wiadomości Lek 2020;73:1154–7. http://dx.doi.org/10.36740/WLek202006114.

[7] Irwin MR. Sleep and inflammation: partners in sickness and in health. Nat Rev Immunol 2019;19:702–15. http://dx.doi.org/10.1038/s41577-019-0190-z.

[8] Jain SV, Kothare SV. Sleep and Epilepsy. Semin Pediatr Neurol 2015;22:86–92. http://dx.doi.org/10.1016/j.spen.2015.03.005.

[9] Delva M, Delva I. Analysis of primary headaches management in Poltava regions. Wiadomości Lek 2021;74:118–21. http://dx.doi.org/10.36740/WLek202101123.

[10] Mayer G, Happe S, Evers S, Hermann W, Jansen S, Kallweit U, et al. Insomnia in neurological diseases. Neurol Res Pract 2021;3:15. http://dx.doi.org/10.1186/s42466-021-00106-3.

[11] Sahraian MA, Rezaali S, Hosseiny M, Doosti R, Tajik A, Naser Moghadasi A. Sleep disorder as a triggering factor for relapse in multiple sclerosis. Eur Neurol 2017;77:258–61. http://dx.doi.org/10.1159/000470904.

[12] Bishir M, Bhat A, Essa MM, Ekpo O, Ihunwo AO, Veeraraghavan VP, et al. Sleep deprivation and neurological disorders. Biomed Res Int 2020;1–19. http://dx.doi.org/10.1155/2020/5764017.

[13] Shkodina AD, Tan SC, Hasan MM, Abdelgawad M, Chopra H, Bilal M, et al. Roles of clock genes in the pathogenesis of Parkinson's disease. Ageing Res Rev 2022;74:101554. http://dx.doi.org/10.1016/j.arr.2021.101554.

[14] Saletin JM, Memory:. Necessary for deep sleep? Curr Biol 2020;30:R234–6. http://dx.doi.org/10.1016/j.cub.2020.01.038.

[15] Baglioni C, Battagliese G, Feige B, Spiegelhalder K, Nissen C, Voderholzer U, et al. Insomnia as a predictor of depression: A meta-analytic evaluation of longitudinal epidemiological studies. J Affect Disord 2011;135:10–9. http://dx.doi.org/10.1016/j.jad.2011.01.011.

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