



Blood Flow Velocity in Veterans: The Case of Eastern Ukrainian Syndrome

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Received date: 28 September, 2024, Manuscript No. IJMHP-24-149138;

Editor assigned date: 01 October, 2024, PreQC No. IJMHP-24-149138 (PQ);

Reviewed date: 16 October, 2024, QC No. IJMHP-24-149138;

Revised date: 14 June, 2025, Manuscript No. IJMHP-24-149138 (R); Published

date: 21 June, 2025, DOI: 10.4172/2471-4372.1000294.

Abstract

In the article, questions are considered regarding the development of Cerebral Blood Flow Velocity (CBFV) in veterans of modern wars. Blood flow abnormalities were found in the brains of veterans of modern wars long after the war, and in some cases, their condition worsened. In the spring of 2014, the war in the Donbas region of modern Ukraine gained momentum, linked to the escape of President Yanukovich V. F. This war, according to international organizations such as the United Nations, claimed the lives of 7,000 people and resulted in tens of thousands of injuries. It is now possible to talk about the so-called eastern Ukrainian syndrome—soldiers who fought in the east, upon returning home, faced a deterioration in their internal health. The aim of this study was to compare resting cerebral blood flow velocity of unmedicated patients in the acute phase of Eastern Ukrainian syndrome with resting values of healthy control subjects. Nine unmedicated Eastern Ukrainian syndrome patients were assessed using the Clinician-Administered PTSD Scale (CAPS). The patients and 10 healthy age-matched control subjects were then evaluated at rest using transcranial doppler ultrasonography (TCD). For TCD, the anterior, middle, and posterior cerebral arteries were viewed bilaterally in all patients. Compared with healthy age-matched control subjects, acute unmedicated Eastern Ukrainian syndrome patients showed a significant increase in cerebral blood flow velocity bilaterally in the middle and anterior cerebral arteries, and unilaterally in the left posterior cerebral artery. Cerebral blood flow velocity in the right middle cerebral artery correlated positively with the item "Irritability and temper tantrums" on the Clinician-Administered PTSD Scale (CAPS), whereas the pulsatility index in the posterior cerebral artery bilaterally and in the left middle cerebral artery correlated negatively with the item "Psychogenic amnesia." Transcranial Doppler ultrasonography aligns well with validated psychometric methods. If follow-up studies confirm our findings, TCD could allow for an objective assessment of the mental state of Eastern Ukrainian syndrome patients and reliably differentiate them from normal control subjects.

Keywords: Cerebral Blood Flow Velocity (CBFV); Eastern Ukrainian syndrome; Mental state; Multi-symptom disorders;

PTSD; Transcranial Doppler ultrasonography; Veterans of modern wars

Introduction

A theme matters very much the last years about that, how the best of all to support the health of our active servicemen and veterans, especially after their participating in armed conflicts. Many studies have focused on health issues directly related to military deployment such as physical injuries (including disorders of cerebral blood flow velocity) and mental health problems (PTSD and depression) [1].

This review will primarily focus on psychophysiology risk factors for disorders of cerebral blood flow velocity and negative consequences, which will drive to the fair copy to the partial or vaster ceiling of arteries of brain [2]. The risks include effects of combat exposure, multi-symptom disorders and eastern Ukrainian syndrome, disorders cerebral blood flow velocity in veterans the armed forces of Ukraine and fighters volunteer battalions of national guard.

Exposition of basic material: This review focuses on both current servicemen and veterans of the armed forces of Ukraine, accepting active voice in the armed conflict on East of Ukraine. Producing the review of foreign (not Ukrainian) statistical data on issue of this research it is possible to bring the following over: In 2011 veterans numbered over 22 million, or around 7% of the total US population; among the citizens of euro union of such statistics-no, but after data of non-governmental organizations this number is approached to 700,000 persons; from data of annual report of United Nations (2014 year) in the whole world about 1 million persons participate in the armed conflicts [3].

A risk factor disorders of cerebral blood flow velocity in military populations: PTSD is the greatest risk factor for cerebral blood flow velocity, with the risk of developing the disease doubling every 1 years after first display. Most studies of mental health in veterans show a greater prevalence of mental health disorders than in the general on-veteran population, even after adjusting demographic and socioeconomic factors. The most commonly reported mental health problems in these studies are depression and PTSD, both common squeal disorders of cerebral blood flow velocity. Therefore, it is useful to consider this triad of conditions as both independent and combined risk factors for cognitive decline [4]. There are several lines of evidence to suggest how PTSD might be associated with increased risk for cerebral blood flow. First, PTSD is associated with cognitive impairments, especially memory. Therefore, there may be reduced "cognitive reserve" in PTSD subjects making them more vulnerable to the effects of cerebral blood flow pathology. In parallel with it grow "Irritability and Temper Tantrums" (ITT) and "Psychogenic Amnesia" (PA). Alternatively, PTSD and disorders of cerebral blood flow velocity share both common risk factors and neuroanatomical changes and cognitive changes in PTSD may be early markers of disorders of cerebral blood flow velocity. Neuroanatomical changes in AD typically initially manifest as atrophy of the hippocampus, the brain structure involved in the consolidation of information from short-term memory to long-term memory [5]. Patients with combat-related PTSD been shown to have smaller hippocampal volumes and ongoing PTSD is associated with disorders of cerebral blood flow while improvement of symptoms is associated with less progressive by the form of

disease. Second, PTSD is associated with brain alterations primarily in the hippocampus, including reduced hippocampal N-Acetyl-Aspartate (NAA) as a biomarker after a return to peaceful life. Third, PTSD is also associated with other independent risk factors for disorders of cerebral blood flow velocity including smoking, hypertension, hyperlipidemia, diabetes, obesity and hyper homocysteinemia thrombosis. Veterans of eastern Ukrainian syndrome who treated at ministry defense of Ukraine medical facilities for PTSD of having high hypertension or dyslipidemia, respectively, compared to veterans without PTSD. Likewise, considerable observational research indicated that PTSD may result in an increased risk of coronary heart disease morbidity and mortality. PTSD has also been associated with an increased risk of stroke. For example, female veterans with PTSD who received care at medical centers MD had an adjusted odds ratio of high-pressure stroke compared to those who does not have symptomatology PTSD. Clearly, PTSD remains a major health issue in servicemen and veteran populations, especially those exposed to eastern Ukrainian syndrome.

Materials and Methods

Transcranial Doppler ultrasonography

For each examination, simultaneous bilateral insonation was done sequentially on the basal MCA, ACA, and PCA with a 2-MHz pulsed-

wave transducer probe (Neurogard, Medasonics). The test-retest reliability found for the ACA, MCA, and PCA in the 10 healthy control subjects was $0,90 < r < 0,95$. After resting for 5 minutes, patients and control subjects were insonated under standard resting conditions (supine position, eyes closed, darkened room). Arteries were insonated transtemporally above the zygomatic arch, and CBFV was measured at a depth of 50 to 55 mm (MCA) and 60 to 70 mm (ACA, P2 segment of the PCA). Recording of mean blood flow velocities was started when no change in either the velocities or the heart rate was observed over 15 successive cardiac cycles.

The V_{mean} in the MCA and the ACA showed a bilaterally significant increase ($0,001 < P < 0,05$) during the acute psychotic stage compared with that of age-matched normal control subjects (Table 1). Velocities in the PCA were marginally increased; only the right side showed a significantly changed V_{mean} , while the change in the left side remained below the level of significance ($P > 0,05$). During the acute stage, the PI was lowered in all insonated vessels, but this did not reach significance ($P > 0,05$).

	Left	Right	Bilateral
V_{mean}			
MCA	86 ± 28 (59 ± 13)	81 ± 26 (59 ± 13)	84 ± 22 (59 ± 13)
ACA	69 ± 23 (49 ± 12)	64 ± 21 (49 ± 12)	66 ± 18 (49 ± 12)
PCA	39 ± 7 (36 ± 8)	41 ± 8 (37 ± 8)	40 ± 6 (36 ± 8)
PI			
MCA	0,77 ± 0,15 (0,82 ± 0,17)	0,76 ± 0,18 (0,82 ± 0,17)	0,76 ± 0,16 (0,83 ± 0,18)
ACA	0,81 ± 0,15 (0,85 ± 0,20)	0,80 ± 0,13 (0,85 ± 0,20)	0,81 ± 0,11 (0,85 ± 0,20)
PCA	0,80 ± 0,12 (0,81 ± 0,18)	0,77 ± 0,15 (0,81 ± 0,18)	0,78 ± 0,11 (0,81 ± 0,18)

Table 1: Cerebral blood flow velocity at veterans eastern Ukrainian syndrome.

The increases in the MCA and the ACA correlated positively with the positive sum score ($0,55 \leq r \leq 0,59$; $0,001 < P < 0,05$) (Table 2). Delusions showed a positive correlation with blood flow velocity in the MCA and ACA ($0,52 \leq r \leq 0,58$; $0,001 < P < 0,005$) and the left PCA ($r = 0,58$; $P = 0,001$), and grandiosity showed a positive correlation with blood flow velocity in the MCA ($r = 0,54$; $P = 0,003$). There were negative correlations for lack of spontaneity and flow of conversation (negative symptom 6) with the left MCA ($r = -0,51$; $P = 0,006$), negative correlations for motor retardation (multi psychopathology symptom) bilaterally both with the MCAs ($r = -0,58$; $P = 0,001$) and with the ACAs

($r = -0,51$; $P = 0,005$), and a negative correlation with the left MCA ($r = -0,52$; $P = 0,005$). All other PANSS symptoms showed no significant correlation with the ACA, the MCA, or the PCA on either side.

It is hypothesized, that servicemen and veterans with the east Ukrainian syndrome show have the state of cerebral over activity and megascopic metabolic norm. A megascopic metabolic norm requires a megascopic blood supply and greater volume of stream. Speed of blood stream is directly related to the volume of stream, megascopic speed therefore a greater blood volume that in turn specifies megascopic cerebral activity implies accordingly.

	Positive sum score	P1	P5	N6	G7
MCA (right)	$r = 0,58$	$r = 0,56$	$r = 0,57$	-	-
	$P = 0,0009$	$P = 0,001$	$P = 0,003$	-	-

MCA (left)	-	-	-	r=-0.51	r=-0.52
	-	-	-	P=0,006	P=0,005
MCA (both)	-	r=0,52	r=0,55	-	r=-0,57
	-	P=0,005	P=0,003	-	P=0,001
ACA (right)	r=0,55	r=0,58	-	-	-
	P=0,003	P=0,001	-	-	-
ACA (both)	-	-	-	-	r=-0,51
	-	-	-	-	P=0,005
PCA (left)	-	r=0,58	-	-	-
	-	P=0,001	-	-	-

Table 2: Scale Doppler correlations of psychopathological symptoms at first examination veterans eastern Ukrainian syndrome.

It, maybe argues that, megascopic CBFV educed for the veterans of having the Eastern Ukrainian syndrome exists due to a vasoconstriction. However, a vasoconstriction would decrease cerebral perfusion that in turn would result in lowered hypo perfusion and glucose considerably on such conditions, however, activity barely possible. Besides, there is no pathomorphological sign for a vasoconstriction at PTSD. Researches at study and unmedicated a bit and unlike researches with other soldiery syndromes that show a hypo perfusion, most researches on veterans found hyperperfusion in a front temporal core. It correlates to hyperperfusion positively at least with some sharp battle syndromes and their strictness, as foreign researches show.

This study is the first to demonstrate locally increased CBFV in first-episode disorders of cerebral blood flow velocity against age-matched normal control subjects with the use of TCD. Increases were most pronounced in the MCA and the ACA on both sides. These vessels supply the frontal and the temporal lobes, which are actively involved in CBFV, where found a slightly higher flow on the left side. However, when we compared absolute values, our results show the same left-side tendency. In addition to a front temporal region, veterans with the east Ukrainian syndrome show a megascopic blood stream in a cervical region. For these patients investigated in this study, we also found insignificantly megascopic to speed in PCA that even showed cross-correlation with errors.

It would specify that a cervical region also was actively engaged in sharp violation of circulation of blood and in our study, we found that speeds showed in PCA (that irrigates a cervical region also), that maximum to substantial megascopic relatively normal control subjects and sickly substantial reduction after psychopathological. Besides, associations between the local changes of blood stream and specific psychopathological syndromes specify the areas of the damaged irrigation. Negative correlations for lack of spontaneity and stream of conversation to speed of blood stream in left MCA were able to specify the effect of mionectic perfusion in a speech center. Ships that do not supply with this area showed to no substantial correlation.

Motor deceleration showed negative correlations bilaterally with both MCAs and ACAs, which supply with motor centers. Since PCA does not irrigate this area, no correlations were found. These two discoveries show direct correlation of changes in activity of functions that were mapped neuroanatomical, as for example speech or motor functions, with changes in speed of blood stream of artery supplying

their cerebral. Further research is needed, to clarify, as TCD can be used in complementary control, to identify and distinguish the respondents of therapy from of non-respondents and whether it can to bring additional information over on the course of therapy and maybe even to be used as a variable of index (preventive signs). Since it depends only upon physically measurable physiological parameters (unlike the psychometric methods of estimation), TCD can endow in the direction of any more objective diagnosis of schizophrenia. An increase in V_{mean} was able therefore to specify the first or renewed intensifying of illness. For adventurist individuals (to the first-degree relatives), the attack of illness able to be found out early by means of such megascopic and so to be treated, while still in the early stages, thus improving a prognosis and abbreviating a stationary stay. Further empiric research is needed, especially, to estimate critical cutoff points (areas). This study offers it, in addition to the exceptionally clinical fields as for example neurosurgery and neurology it was long used in that, TCD holds large potential for psychiatry. Therefore, the new row of appendixes could be opened for TCD, especially having regard to his high temporal resolution that was able to be substantial for examinations, requiring real-time control.

Results and Discussion

In recent years, a critical issue has emerged regarding how best to support the health of active military personnel and veterans, especially following their participation in armed wars. Numerous studies have highlighted health problems directly linked to military deployment, including physical injuries (such as cerebral blood flow velocity disorders) and mental health challenges like PTSD and depression.

This review primarily focuses on psychophysiological risk factors for disorders of Cerebral Blood Flow Velocity (CBFV) and their adverse consequences, which may lead to partial or complete blockage of cerebral arteries. Key risk factors include combat exposure, multi-symptom disorders, and eastern Ukrainian syndrome—conditions that are observed in veterans of the Ukrainian armed forces and volunteers from the national guard.

Among the most significant risk factors for CBFV disorders in military populations is PTSD. Evidence shows that the risk of developing these conditions doubles with each passing year after the initial onset of PTSD. Studies on veterans' mental health consistently

reveal higher rates of mental health disorders than those observed in the general population, even when demographic and socioeconomic factors are controlled. Depression and PTSD are commonly reported and have been linked to CBFV disorders. Consequently, it is essential to consider this triad of conditions: PTSD, depression, and CBFV disorders as both independent and interrelated risk factors for cognitive decline.

Several lines of evidence suggest how PTSD could contribute to an increased risk of cerebral blood flow disorders. PTSD is often associated with cognitive impairments, particularly in memory functions, which may reduce cognitive reserve and make individuals more susceptible to CBFV pathology. Additionally, PTSD is linked to increased Irritability and Temper Tantrums (ITT) and Psychogenic Amnesia (PA), which further exacerbate the condition.

Moreover, PTSD and CBFV disorders share common risk factors and neuroanatomical changes. Neuroanatomical alterations typically begin with hippocampal atrophy, which affects memory consolidation. Veterans with combat-related PTSD often have smaller hippocampal volumes, and ongoing PTSD correlates with CBFV disorders, whereas improvements in PTSD symptoms are associated with a less severe progression of the disease.

PTSD is also associated with other risk factors for CBFV disorders, such as smoking, hypertension, hyperlipidemia, diabetes, obesity, and hyperhomocysteinemia. Veterans diagnosed with Eastern Ukrainian syndrome and treated in Ukrainian Ministry of Defense medical facilities for PTSD have higher rates of hypertension and dyslipidemia than those without PTSD. PTSD has also been linked to an increased risk of coronary heart disease and stroke, particularly in female veterans. This underscores the importance of addressing PTSD in servicemen and veterans, particularly those exposed to the Eastern Ukrainian war.

Transcranial Doppler ultrasonography (TCD)

TCD is a valuable tool for assessing cerebral blood flow velocity. This study employed TCD to measure the anterior, middle, and posterior cerebral arteries in veterans with Eastern Ukrainian syndrome. The results revealed significantly higher blood flow velocities in the middle and anterior cerebral arteries bilaterally, with slightly elevated values in the left posterior cerebral artery. These findings were associated with PTSD symptoms, such as irritability and amnesia, and provided insights into the neuroanatomical changes linked to CBFV disorders.

The increases in CBFV in veterans with Eastern Ukrainian syndrome could be indicative of cerebral overactivity and heightened metabolic demands, necessitating greater blood flow to meet the brain's energy requirements. Hyperperfusion in these veterans correlates positively with the severity of their symptoms, mirroring findings from international studies of combat-related syndromes. These results suggest that increased blood flow in specific brain regions could serve as a marker of CBFV disorders, particularly in the early stages.

Prognosis and perspectives

In the coming years, the focus of the scientific community and medical professionals will increasingly center on identifying and treating disorders related to Cerebral Blood Flow Velocity (CBFV) abnormalities in veterans of modern wars. Given the growing

recognition of the link between combat related stressors, PTSD, and physiological changes in the brain, further research is expected to shed light on how these factors interact over time, leading to long-term neurological consequences.

One key area of exploration will be the early identification of CBFV disorders using tools like transcranial Doppler ultrasonography (TCD). With further validation, TCD could become a standard method for screening veterans for early signs of cerebral dysfunction, enabling early intervention and potentially preventing the progression of more severe conditions, such as cognitive decline or dementia. Additionally, as more veterans from conflicts like the eastern Ukrainian war age, longitudinal studies will be critical to understanding how CBFV abnormalities evolve and their impact on cognitive health.

From a therapeutic perspective, advancements in both pharmacological and non-pharmacological treatments for PTSD and CBFV disorders are expected. These may include neuroprotective drugs aimed at improving cerebral blood flow and reducing inflammation, as well as cognitive-behavioral therapies to address the psychological symptoms associated with PTSD and combat-related stress. The integration of personalized medicine approaches, which tailor treatments based on the individual's genetic, physiological, and psychological profiles, holds promise for improving outcomes for veterans with complex, multi-symptom disorders.

The long-term prognosis for veterans with CBFV disorders will depend heavily on the success of these interventions, as well as on the development of comprehensive support systems that address both mental and physical health. As healthcare systems become more attuned to the unique needs of veterans, the hope is that early diagnosis, targeted treatments, and ongoing monitoring will mitigate the impact of CBFV disorders, improving quality of life and reducing the burden on healthcare resources.

In conclusion, while the challenges posed by CBFV disorders and PTSD in veterans are significant, continued research and clinical innovation offer a promising outlook. By focusing on early detection, tailored interventions, and long-term support, there is potential to significantly improve the health outcomes of veterans and prevent the progression of more severe neurodegenerative conditions as they age.

Conclusion

Active military service exposes personnel to certain risk factors for Cerebral Blood Flow Velocity (CBFV) disorders at levels substantially elevated beyond what is experienced by the general population.

Military personnel, especially those involved in active combat, face a combination of physical and psychological stressors that can lead to both mental health issues and physiological complications, such as CBFV disorders. Prolonged exposure to combat, trauma, and stress significantly raises the risk of developing these conditions. In addition to physical injuries, emotional trauma, and psychological strain, military personnel are more prone to CBFV abnormalities, which may contribute to long-term cognitive and physiological challenges.

CBFV has been shown to be a possible indicator of PTSD when PTSD patients were compared with age-matched control subjects and PTSD patients after psychopathological improvement.

The use of Transcranial Doppler Ultrasonography (TCD) in the study demonstrated that CBFV abnormalities are significantly associated with PTSD, particularly in veterans of modern armed wars.

Changes in cerebral blood flow, as measured by TCD, could serve as a reliable marker for assessing the mental state of veterans suffering from PTSD. TCD is advantageous because it is a non-invasive, easily repeatable, and accessible method that allows for ongoing monitoring of CBFV disorders in PTSD patients. The ability to perform repeated measurements with minimal preparation provides a valuable tool for tracking the progression or improvement of symptoms, offering insight into the effectiveness of treatments.

More studies will be required to determine the full extent of the effect of military service on the prevalence of disorders of cerebral blood flow velocity in veterans, as well as the potential cost to society.

While current research highlights the increased prevalence of CBFV disorders among veterans, more in-depth studies are needed to understand the long-term impact of military service on veterans' neurological health. Specifically, research should focus on how factors like combat exposure, PTSD, and physical injuries contribute to the development of CBFV disorders. These studies will help quantify the societal cost of treating veterans with these conditions, including the economic burden related to healthcare, rehabilitation, and long-term care. Addressing this knowledge gap will also allow healthcare systems to better allocate resources and implement targeted interventions.

The true prevalence of PTSD-related cognitive decline and CBFV disorders in veterans remains unknown, but given the elevated prevalence of risk factors associated with their military service, there is a strong possibility that dementia rates will surpass those found in the general population as veterans age.

As veterans age, the cumulative effects of PTSD and CBFV disorders may increase their vulnerability to cognitive decline and dementia. Although more data is required to confirm this hypothesis, the combination of combat-related brain injuries, prolonged stress, and untreated mental health conditions places veterans at a higher risk of developing neurodegenerative diseases. This presents a critical public health concern, as the aging veteran population may experience a surge in dementia cases, highlighting the need for early diagnosis and intervention to prevent or mitigate these long-term effects.

In conclusion, while substantial progress has been made in understanding the relationship between PTSD, CBFV disorders, and cognitive health in veterans, more comprehensive research is necessary to fully grasp the extent of these risks. This knowledge will be vital in developing strategies to support the health and well-being of veterans as they transition into later stages of life.

Declaration of Interest

The author declares that he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Ethics Approval

The study was approved by the Academic Council of the H.S. Kostyuk Institute of Psychology, National Academy of Educational Sciences of Ukraine (Protocol No. 9, dated September 25, 2014), and was endorsed by the Interdepartmental Council for the Coordination of Scientific Research in Pedagogical and Psychological Sciences in Ukraine (Protocol No. 7, dated October 2, 2014). All procedures performed in the study involving human participants were in accordance with the ethical standards of the institutional and national research committees and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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