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Influence of cognitive functioning on the effectiveness of treatment of veterans with post-traumatic stress disorder and mild traumatic brain injury

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Abstract. A history of traumatic brain injury in veterans is associated with higher use of mental health services, regardless of psychiatric diagnoses, which makes it important to develop a comprehensive approach to treatment and evaluate its effectiveness. The study aimed to investigate the impact of cognitive functioning among 329 veterans with comorbid post-traumatic stress disorder and mild traumatic brain injury on the effectiveness of combination therapy. The following tests were used to assess cognitive functioning: the Ray-Osterritz test, the Symbolic Communication Test, the Stroop test, and the Verbal Fluency Test. Functioning was assessed using the World Health Organization Questionnaire for the Assessment of Disability. The effectiveness of the combination therapy was also assessed using the Four-Dimensional Symptom Inventory. The influence of cognitive functioning on the effectiveness of 8-week complex therapy for veterans with this comorbidity was confirmed. The results of the Trail Making Test had statistically significant negative correlations with the cognitive sphere scale ($\rho = -0.237$; $p = 0.0117$) and the integral index of the World Health Organization questionnaire for the assessment of disability ($\rho = -0.192$; $p = 0.0424$), as well as positive correlations with the scales of self-care ($\rho = 0.2038$; $p = 0.0311$) and daily activity ($\rho = 0.2048$; $p = 0.0303$). It was found that patients with post-traumatic stress disorder, mild traumatic brain injury and their comorbidity responded differently to therapy, which was determined by the clinical features of their cognitive processes, namely associative performance, control rigidity/flexibility, attention, working memory and executive function. The dynamics of cognitive functioning differed in each group. It was also found that cognitive symptoms were targeted by therapy, as evidenced by their reduction after the intervention. The data obtained will allow for a more efficient and comprehensive organization of specialised psychiatric care for veterans, and cognitive functioning is predictive of the effectiveness and duration of treatment

Keywords: stress-related mental disorder; brain injury; cognitive disorders; executive function; treatment; veterans; comorbidity

Introduction

The comorbidity of post-traumatic stress disorder (PTSD) and traumatic brain injury (TBI) is the most common medical combination among both civilian and military populations and has many common clinical symptoms [1, 2]. Both conditions are characterised by neurocognitive, behavioural, and affective symptoms that are caused by functional impairments in the frontal brain area, including impairments in executive functioning, working memory, planning, multitasking, complex decision-making, judgement, impulsivity, emotional lability, and disinhibition, as well as changes in personality, empathy, and social behaviour [3-5].

L.Z. Kong *et al.* [6], described the pathogenesis of TBI in the military and noted its connection with mechanical impacts resulting from the interaction of an explosive air wave, blunt force trauma and projectile penetration. S.B. Shively *et al.* [7], in their study of the pathophysiology of TBI and its relationship with chronic post-traumatic encephalopathy, showed that direct focal, multifocal

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or diffuse damage to neurons and their processes as well as glia and the vascular network, triggers a dynamic cascade of complex neurochemical and metabolic changes in the cellular and extracellular space of brain tissue, which lead to secondary trauma and represent ischaemic and hypoxic damage, leading to increased intracranial pressure, hydrocephalus, and inflammatory changes [1, 8, 9]. N. Marklund *et al.* [8] indicated that one moderate or severe TBI is associated with at least a twofold increase in the risk of dementia over the course of a lifetime. There is growing evidence of a link between TBI and neurodegeneration due to the accumulation, misfolding and aggregation of many abnormal proteins, including β-amyloid, α-synuclein, tau protein, and tar proteins that bind deoxyribonucleic acid (DNA) [9]. Studies also confirmed a long-term association between TBI and Parkinson's disease, Creutzfeldt-Jakob disease, and amyotrophic lateral sclerosis, and repetitive mild TBI is a risk factor for chronic traumatic encephalopathy (CTE) [10].

Modern neuroimaging studies allowed identifying both nosospecific and general neural substrates common to PTSD and TBI, and thus help to determine the clinical interaction of symptoms, and their diagnostic affiliation and improve the possibility of targeted treatment. While PTSD and TBI demonstrate significant overlap clinically and symptomatically, there is currently no generally accepted way to determine this aetiology beyond clinical judgment. Determination of neurobiological changes in this comorbidity was quite problematic due to its multi-aetiology, time since TBI, and the presence of premorbid TBI and psychiatric conditions [11].

Additional indicators of potential interest for understanding whether neurobiological substrates can correlate with neurocognitive deficits that negatively affect recovery from TBI comorbid with PTSD are genetic indicators that allow assessing markers of vulnerability and resilience, neuroimaging markers, and neuropsychological profile [12]. The literature review revealed a significant correlation between cognitive functioning, including memory, attention, executive functions, and associative performance, in veterans with PTSD and TBI. However, it is important to note that the analysis was not sufficient to fully understand the impact of these features on the effectiveness of 8 weeks of combined therapy. Thus, the study aimed to investigate the impact of cognitive functioning (parameters of memory, attention, executive functions, associative performance) in veterans with PTSD and mTBI on the effectiveness of 8 weeks of combined therapy.

Materials and Methods

During 2018-2020, a study was conducted at the Ternopil Regional Clinical Psychoneurological Hospital of 329 veterans aged 19 to 64 years, who were divided into three groups: patients with PTSD+TBI comorbidity (hereinafter referred to as CTBI) (n=108), patients with PTSD only (n=109), and patients with mild TBI only (hereinafter referred to as mTBI) (n=112). The initial interview included a survey using the Unified Patient Study Card developed by the author, which included a section on General Indicators and Current Life Problems: some socio-demographic indicators (age, gender, family, educational, social and employment status, duration of stay in the combat zone (up to seven days; up to one month; up to three months; up to six months and up to one year). Based on the International Statistical Classification of Diseases and Related Health Problems [13], a modal analysis of the existing problems was conducted, assessing the presence of factors from the following diagnostic categories: Z55, Z56, Z59, Z56, Z60, Z61, Z62, Z63, Z64, Z72, Z73.

The requirements and principles of bioethics were considered in all studies of this research paper, the rules of patient safety were followed, and the rights and canons of human dignity, moral and ethical standards were preserved according to the basic provisions of Good Clinical Practice (GSP) [14]. The Council of Europe Convention on Human Rights and Biomedicine [15], the World Medical Association Declaration of Helsinki on Ethical Principles for Scientific Medical Research Involving Human Subjects [16], and the Code of Ethics for Scientists of Ukraine [17] were also observed.

After providing informed consent to participate in the study, the subjects underwent a course of combined treatment in the form of standard therapy following the Unified Protocols for PTSD and mTBI and additional psychotherapeutic intervention, which consisted of a combination of psychoeducation, motivational interviewing, and Acceptance and Commitment Therapy for PTSD (ACT) (8 psychotherapy sessions 1-2 times a week) and transcranial direct current stimulation (tDCS) (10 sessions daily).

The psychodiagnostic study of cognitive functioning was implemented using Trail Making Test (TMT), in which the TMT-A part included dynamic parameters of attention (the volume and level of its voluntary regulation), and the TMT-B part – executive function; The Ray-Osterrieth Complex Figure Test (ROCFT) to study visual memory and visual-spatial syntheses by copying (ROCFT-1), immediate reproduction (ROCFT-2) and delayed reproduction (ROCFT-3) of a reference figure; The Stroop Color and Word Test (StroopCWIT) – to assess the selectivity of attention, where Stroop-1 is the congruent part of the test, Stroop-2 is the incongruent part of the test, Δ Stroop is the index of rigidity/rigidity of the control; Verbal Fluency Test (VFT) – to assess verbal associative performance (letter part, VFT-1) and lexical system disorders (categorical part, VFT-2).

Functioning was assessed using the World Health Organization (WHO) test for functional evaluation per WHODAS 2.0 scale (World Health Organization Disability Assessment Schedule) [18] in separate domains: CW – cognitive sphere; MW – mobility; SW – self-care; RW –relationships; LW – daily activity; PW – social activity; WHO – total score. The efficacy of the combination therapy was also assessed by the dynamics of clinical symptom severity using the Four-Dimensional Symptom Questionnaire

(4DSQ) with separate scales: DIS – distress; DEP –depression; ANX – anxiety; SOM – somatisation.

The results were analysed using descriptive statistics, Fisher's φ*-angular transformation, Mann-Whitney U-test, Wilcoxon's W-test, Kolmogorov-Smirnov test for two independent samples, and discriminant analysis. The correlation between the WHODAS 2.0 scores and the StroopCWIT, VFT, TMT, and ROCFT scores was determined by calculating Spearman's rank correlation coefficient, as the data did not follow a normal distribution. At the same time, the WHODAS 2.0 results obtained at the initial examination and after therapy were analysed, and the examination using the StroopCWIT, VFT, TMT and ROCFT tests were performed at the initial examination.

Results and Discussion

The influence of cognitive functioning on the effectiveness of 8-week complex therapy for veterans with PTSD and mTBI was conducted separately for each clinical group: PTSD, TBI, and CTBI. In the initial examination of patients with PTSD, statistically significant correlations were found between certain indicators of cognitive functioning and the WHODAS 2.0 questionnaire scales (Table 1), including the mobility scale (MW), self-care scale (SW) and social activity scale (PW). At the same time, the indicators of the incongruent part (Stroop-2) and the flexibility-rigidity coefficient (Δ Stroop) of the Stroop test showed negative correlations only with the indicators of the WHODAS 2.0 mobility scale (ρ≥-0.2; p≤0.0369).

Table 1. Correlations between indicators of cognitive functioning and scales of the WHODAS 2.0 questionnaire at the first examination of PTSD patients

scale		CW	MW	SW	RW	LW	PW	WHO
ROCFT-1	ρ	0.091	0.1453	0.0709	-0.108	0.1336	-0.032	0.1195
	p	0.3469	0.1318	0.4639	0.2642	0.1661	0.745	0.216
ROCFT-2	ρ	0.1724	-0.062	0.0726	-0.086	-0.115	0.0204	-0.011
	p	0.073	0.5233	0.4529	0.3714	0.2337	0.8334	0.9095
ROCFT-3	ρ	-0.072	-0.053	-0.21	0.0034	-0.024	0.0788	-0.019
	p	0.4549	0.5856	0.028	0.9723	0.8011	0.4153	0.8449
TMT-A	ρ	0.044	-0.053	0.2793	-0.024	0.0255	-0.051	0.0594
	p	0.6499	0.5808	0.0033	0.8015	0.7923	0.5983	0.5393
TMT-B	ρ	-0.066	0.2319	-0.222	-0.158	-0.085	0.0157	-0.109
	p	0.495	0.0152	0.0203	0.1012	0.3772	0.8714	0.258
VFT-1	ρ	-0.028	0.1462	0.021	-0.122	0.1076	-0.198	-0.058
	p	0.775	0.1294	0.8285	0.2045	0.2656	0.0385	0.5469
VFT-2	ρ	0.1535	0.0413	-0.101	-0.075	-0.151	0.1552	0.0002
	p	0.111	0.6697	0.2964	0.4389	0.1161	0.1071	0.998
Stroop-1	ρ	-0.087	0.0337	-0.06	0.0096	-0.111	-0.045	-0.118
	p	0.3693	0.728	0.5345	0.9207	0.2499	0.6418	0.2205
Stroop-2	ρ	-0.025	-0.26	-0.044	0.0402	-0.049	-0.045	-0.092
	p	0.7948	0.0064	0.6469	0.6782	0.6108	0.6396	0.341
Δ Stroop	ρ	0.047	-0.2	0.0242	0.0103	0.0603	-0.021	0.0292
	p	0.6278	0.0369	0.8029	0.9153	0.533	0.8262	0.7628

Notes: CW – cognitive domain; MW – mobility; SW – self-care; RW – relationships; LW – daily activities; PW – social activities; WHO – overall score

Source: compiled by the author

The scores of the letter part of the VFT (VFT-1) had subtle but statistically significant negative correlations (ρ=-0.198; p=0.0385) only with the scores of the social activity scale, and the scores of The Ray-Osterrieth Complex Figure Test Delayed Reproduction Scale (ROCFT-3) – only with the scores of the self-care scale (ρ=-0.21; p=0.028). A slightly wider range of correlations was observed in the analysis of the Trail Making Test (TMT): The indicators of its part B had positive correlations with the indicators of the Mobility Scale (MW) of the WHODAS 2.0 at the initial examination of the PTSD group (ρ=0.2319; p=0.0152) and negative correlations with the self-care scale – SW (ρ=-0.222; p=0.0203), while the indicators of part A of the TMT test had, on the contrary, positive correlations with the self-care scale (ρ=0.2793; p=0.0033). Thus, at the time of the initial examination in the PTSD group, more pronounced mobility disorders occurred in those respondents who had greater problems with the use of distributed attention, memory, and executive function, as well as poorer development of sensory and perceptual functions and, conversely, a more pronounced ability to inhibit stronger verbal functions for the sake of colour perception.

The analysis of WHODAS 2.0 data obtained during the re-examination of patients with PTSD indicates a different distribution of correlations (Table 2). The CW scale scores had significant correlations only with the scores of the letter part of the VFT test (ρ=0.1996; p=0.0375), which, in turn, also had negative correlations (ρ=-0.189; p=0.0486) with the LW scale scores of the WHODAS 2.0, and the categorical part of the VFT test with the SW scale scores

(ρ=-0.213; p=0.0263). The Ray-Osterrieth Complex Figure Test only revealed a rather weak negative correlation (ρ=-0.198; p=0.0386) with the RW scale of the WHODAS 2.0 methodology, and part B of the TMT test showed a negative correlation (ρ=-0.245; p=0.0102) with the SW scale. As for the indicators of the StroopCWIT test, the indicators of its congruent part were negatively correlated with the indicators of the RW scale (ρ=-0.227; p=0.0177), and the incongruent part – with the indicators of the SW scale (ρ=-0.241; p=0.0116).

Table 2. Correlations between indicators of cognitive functioning and scales of the WHODAS 2.0 questionnaire at the second examination of PTSD patients

scale		CW	MW	SW	RW	LW	PW	WHO
ROCFT-1	ρ	-0.154	0.1288	0.1642	-0.014	0.0713	0.1441	0.111
	p	0.11	0.1818	0.0881	0.8888	0.4613	0.135	0.2503
ROCFT-2	ρ	-0.021	-0.028	0.0418	-0.198	-0.036	-0.086	-0.144
	p	0.8265	0.7756	0.6659	0.0386	0.7136	0.3717	0.1343
ROCFT-3	ρ	0.0156	-0.048	-0.183	0.0134	0.1137	-0.041	0.0145
	p	0.8718	0.6228	0.0566	0.8899	0.2393	0.6706	0.881
TMT-A	ρ	0.0796	-0.09	0.0619	-0.162	-0.012	-0.096	-0.119
	p	0.4108	0.3521	0.5226	0.0921	0.9008	0.321	0.2176
TMT-B	ρ	-0.089	-0.03	-0.245	0.0267	-0.009	0.0545	-0.045
	p	0.3564	0.7569	0.0102	0.7829	0.9233	0.5732	0.6412
VFT-1	ρ	0.1996	-0.009	-0.155	-0.017	-0.189	-0.058	-0.108
	p	0.0375	0.9277	0.1079	0.8643	0.0486	0.5522	0.2649
VFT-2	ρ	-0.133	0.0894	-0.213	0.0585	0.0528	0.1397	0.0772
	p	0.1677	0.3554	0.0263	0.5454	0.5857	0.1474	0.4247
Stroop-1	ρ	-0.066	0.1618	0.1092	-0.227	0.0869	0.0783	0.0118
	p	0.4935	0.0929	0.2583	0.0177	0.3688	0.4184	0.9031
Stroop-2	ρ	-0.098	0.0276	-0.241	-0.104	0.1613	0.1348	0.0992
	p	0.3104	0.7756	0.0116	0.283	0.0938	0.1621	0.3048
Δ Stroop	ρ	-0.011	-0.068	-0.235	0.0745	0.0298	0.0463	0.0553
	p	0.9095	0.4813	0.0139	0.4411	0.7587	0.6327	0.5679

Notes: CW – cognitive domain; MW – mobility; SW – self-care; RW – relationships; LW – daily activities; PW – social activities; WHO – overall score
Source: compiled by the author

Thus, the peculiarities of the cognitive functioning of patients with PTSD were identified, which in some way prevented the reduction of the symptoms of the underlying disease, namely after completion of treatment, more pronounced disorders in the field of self-care persisted in those patients who, at the time of the start of therapy, had a reduced stock of semantic memory, development of the lexical system and executive functions. However, they demonstrated the ability to distribute attention and working memory more actively. Impairments in the area of relationships persisted to a greater extent in patients who had sufficiently well-developed verbal and language functions, and impairments in daytime activity were lower in those respondents with higher verbal associative performance. On the other hand, patients with PTSD who had more severe impairments in daily activities, self-care, and relationships maintained more severe impairments in the cognitive domain even after therapy. The correlation analysis of the above methods in the TBI group revealed quite different features (Table 3).

Table 3. Correlations between cognitive functioning and WHODAS 2.0 scales in the first examination of patients with TBI

scale		CW	MW	SW	RW	LW	PW	WHO
ROCFT-1	ρ	0.1304	-0.016	0.0514	0.0213	-0.147	0.041	0.0283
	p	0.1706	0.8637	0.5906	0.8238	0.1231	0.6681	0.767
ROCFT-2	ρ	0.0409	0.1052	-0.092	-0.071	-0.07	-0.14	-0.101
	p	0.6685	0.2694	0.3357	0.4551	0.4644	0.1399	0.2917
ROCFT-3	ρ	0.0277	0.0709	-0.036	0.0304	0.0496	-0.004	0.0554
	p	0.7716	0.4573	0.7059	0.7506	0.6034	0.9639	0.5615
TMT-A	ρ	0.0547	-0.201	0.0831	-0.068	0.1333	0.2235	0.0992
	p	0.5667	0.0334	0.3839	0.4789	0.1611	0.0178	0.2982
TMT-B	ρ	0.005	-0.003	-0.021	0.0562	-0.154	0.0203	-0.089
	p	0.9585	0.9728	0.8239	0.5562	0.1045	0.8318	0.3502

Continued Table 3

scale		CW	MW	SW	RW	LW	PW	WHO
VFT-1	ρ	0.1562	0.046	-0.056	-0.197	0.0031	0.0862	0.0597
	p	0.1	0.6298	0.5542	0.0377	0.9738	0.3662	0.5321
VFT-2	ρ	-0.128	0.0187	0.0934	-0.091	0.0804	0.0211	-0.029
	p	0.1802	0.8448	0.3272	0.3416	0.3994	0.8256	0.7624
Stroop-1	ρ	-0.027	0.0534	0.1038	-0.167	0.0476	0.0622	-0.075
	p	0.7803	0.576	0.2761	0.0779	0.6185	0.5147	0.4309
Stroop-2	ρ	0.0377	0.0382	-0.009	0.1008	0.1455	0.0863	0.1264
	p	0.6928	0.6892	0.9233	0.2905	0.126	0.3657	0.1843
Δ Stroop	ρ	0.041	0.0003	-0.103	0.2346	0.069	-0.035	0.1619
	p	0.6677	0.9973	0.2798	0.0128	0.4696	0.7127	0.088

Notes: CW – cognitive domain; MW – mobility; SW – self-care; RW – relationships; LW – daily activities; PW – social activities; WHO – overall score
Source: compiled by the author

There were negative correlations of TMT-A indicators with the MW scale (ρ=-0.201; p=0.0334) and positive correlations with the PW scale (ρ=0.2235; p=0.0178) of the WHODAS 2.0 scale, and the RW scale of this technique had negative correlations with the letter part of the VFT test (ρ=-0.197; p=0.0377) and positive correlations with the StroopCWIT stiffness/flexibility of control (ρ=0.2346; p=0.0128). Thus, among the representatives of the TBI group, at the initial examination, more pronounced impairments in the field of relationships occurred in respondents with low verbal associative performance and a tendency to be released from the influence of the word meaning when it does not correspond to a visual impression, and respondents with insufficient spatial attention and its voluntary regulation had more pronounced impairments in the field of social activity, although they experienced mobility problems to a lesser extent. It is also characteristic that in the TBI group, unlike patients with PTSD, none of the The Ray-Osterrieth Complex Figure Test scores had any statistically significant correlations with the WHODAS 2.0 scores (p≥0.1231).

After the therapy, the clinical picture changed (Table 4). Unlike the first examination, none of the WHODAS 2. 0 tests had statistically significant correlations (p≥0.1461) with the VFT test scores, and the The Ray-Osterrieth Complex Figure Test scores, on the contrary, showed positive correlations: the copying scale (ROCFT-1) – with the RW scale (ρ=0.1863; p=0.0492), and the immediate reproduction scale (ROCFT-1) – with the integral index of the WHODAS 2. 0 (ρ=0.1862; p=0.0493).

Table 4. Correlations between indicators of cognitive functioning and scales of the WHODAS 2.0 questionnaire in the re-examination of patients with TBI

scale		CW	MW	SW	RW	LW	PW	WHO
ROCFT-1	ρ	-0.053	-0.027	-0.12	0.1863	0.0047	-0.094	-0.014
	p	0.5817	0.7791	0.2063	0.0492	0.9609	0.3223	0.8853
ROCFT-2	ρ	0.0688	-0.014	0.1117	0.0761	-0.128	-0.11	0.1862
	p	0.4707	0.8843	0.241	0.4255	0.1776	0.2494	0.0493
ROCFT-3	ρ	-0.027	0.1127	0.0306	0.0113	-0.063	-0.059	0.045
	p	0.7737	0.237	0.7487	0.906	0.5085	0.5383	0.6372
TMT-A	ρ	-0.237	-0.035	-0.093	0.0249	0.0363	0.147	-0.192
	p	0.0117	0.7107	0.3292	0.7942	0.7041	0.122	0.0424
TMT-B	ρ	-0.045	-0.083	0.2038	0.0691	0.2048	0.0742	0.1598
	p	0.6395	0.3839	0.0311	0.4692	0.0303	0.4371	0.0924
VFT-1	ρ	0.0747	0.0288	-0.109	0.1382	0.0746	-0.074	0.0829
	p	0.4339	0.7628	0.252	0.1461	0.4345	0.4357	0.3849
VFT-2	ρ	-0.038	0.0145	-0.118	-0.054	-0.095	-0.136	-0.132
	p	0.6871	0.8794	0.2149	0.5745	0.3208	0.1521	0.1649
Stroop-1	ρ	-0.048	0.1019	-0.051	0.0368	-0.027	-0.002	-0.035
	p	0.6149	0.2852	0.5903	0.7	0.7782	0.9839	0.7116
Stroop-2	ρ	0.0462	-0.197	0.0571	0.0827	0.0637	0.0609	0.0517
	p	0.6284	0.0377	0.5501	0.3859	0.5043	0.5237	0.5879
Δ Stroop	ρ	0.0571	-0.22	0.1014	0.008	0.0864	0.0572	0.0772
	p	0.5499	0.02	0.2875	0.9333	0.3651	0.5491	0.4187

Notes: CW – cognitive domain; MW – mobility; SW – self-care; RW – relationships; LW – daily activities; PW – social activities; WHO – overall score
Source: compiled by the author

The scores of the letter part of the TMT test had statistically significant negative correlations with the CW scale score (ρ=-0.237; p=0.0117) and the WHODAS 2.0 integral score (ρ=-0.192; p=0.0424), as well as positive correlations with the SW (ρ=0.2038; p=0.0311) and LW (ρ=0.2048; p=0.0303) scales. The StroopCWIT scores had statistically significant negative correlations (ρ≥-0.197; p≤0.0377) only with the MW scale of the WHODAS 2.0 methodology, and this applied to both its incongruent part (Stroop-2) and the control stiffness/stiffness index (Δ Stroop).

Thus, the results obtained suggest that after the therapy, patients with a well-developed level of spatial orientation and its regulation experienced a lesser reduction in cognitive impairment and the overall level of disabling effects of TBI, while respondents with a high level of attention span, working memory and executive functions, on the contrary, experienced a more active process of disappearance of impairments in self-care and daily activities. Mobility impairments disappeared more rapidly in patients whose attention was fixed on the meaning of the word at the beginning of therapy, despite the correspondence to the visual impression.

Analysis of the results of calculating Spearman's rank correlation coefficient to identify the relationship between the WHO WHODAS 2.0 Disability Assessment Questionnaire and the StroopCWIT, VFT, TMT, and ROCFT tests in the initial examination of the CTBI group respondents (Table 5), unlike the representatives of the above research groups, did not reveal any statistically significant correlation (ρ≤-0.166; p≥0.0898).

Table 5. Correlation between cognitive functioning indicators and WHODAS 2.0 scales at the first examination of patients in the CTBI group

scale		CW	MW	SW	RW	LW	PW	WHO
ROCFT-1	ρ	-0.02	0.0253	-0.164	0.1229	-0.042	-0.006	0.0049
	p	0.8408	0.7951	0.0898	0.2052	0.6694	0.9482	0.9599
ROCFT-2	ρ	-0.058	0.015	-0.055	-0.108	-0.1	0.1071	-0.089
	p	0.552	0.8777	0.5737	0.2667	0.3024	0.27	0.3609
ROCFT-3	ρ	-0.062	0.0269	0.0869	-0.095	0.1501	-0.017	-0.015
	p	0.5217	0.7826	0.3714	0.3286	0.1211	0.8642	0.8744
TMT-A	ρ	-0.113	-0.074	0.0573	0.0694	0.0099	-0.015	-0.036
	p	0.246	0.4466	0.5555	0.4753	0.9187	0.8752	0.7079
TMT-B	ρ	-0.062	-0.134	-0.036	-0.062	0.0072	-0.108	-0.165
	p	0.5207	0.1666	0.7092	0.5251	0.9409	0.2637	0.0878
VFT-1	ρ	-0.001	-0.196	0.0037	-0.02	-0.044	0.0777	0.0513
	p	0.9894	0.0523	0.9695	0.841	0.6537	0.4244	0.598
VFT-2	ρ	-0.011	-0.146	-0.011	-0.024	0.0451	0.1116	0.0071
	p	0.9069	0.1314	0.9107	0.8037	0.6432	0.2502	0.9418
Stroop-1	ρ	0.122	0.0645	-0.011	-0.024	-0.044	-0.023	0.0353
	p	0.2084	0.5071	0.9104	0.806	0.6489	0.8121	0.7167
Stroop-2	ρ	-0.038	0.0534	0.144	0.0303	-0.166	0.1158	0.0435
	p	0.6951	0.5833	0.1372	0.7558	0.0867	0.2326	0.6549
Δ Stroop	ρ	-0.115	-0.022	0.0745	0.014	-0.085	0.1262	-0.007
	p	0.2339	0.8219	0.4438	0.8855	0.379	0.193	0.9436

Notes: CW – cognitive domain; MW – mobility; SW – self-care; RW – relationships; LW – daily activities; PW – social activities; WHO – overall score
Source: compiled by the author

The calculation of Spearman's rank correlation coefficient of the indicators of these methods and the results of the WHODAS 2.0, which was used to re-examine the respondents after therapy, revealed statistically significant correlations between the CW scale and the delayed reproduction index of the The Ray-Osterrieth Complex Figure Test (ρ=-0.229; p=0.0174) and the ΔStroop scale of the Stroop Color and Word Test and the PW scale (ρ=0.2076; p=0.0311) of the WHODAS 2.0 methodology (Table 6).

Table 6. Correlation between cognitive functioning indicators and WHODAS 2.0 scales in the repeated examination of patients with PTSD+TBI

scale		CW	MW	SW	RW	LW	PW	WHO
ROCFT-1	ρ	0.0081	-0.083	-0.178	0.0145	-0.001	0.0192	0.0158
	p	0.9339	0.391	0.0648	0.8816	0.9902	0.8433	0.8713
ROCFT-2	ρ	-0.083	-0.177	0.1239	0.0909	-5E-04	0.0445	0.0183
	p	0.3903	0.0662	0.2015	0.3496	0.9961	0.6471	0.8512

Continued Table 6

scale		CW	MW	SW	RW	LW	PW	WHO
ROCFT-3	ρ	-0.229	0.007	0.0503	0.0842	-0.015	-0.116	-0.158
	p	0.0174	0.9427	0.605	0.3861	0.8755	0.2332	0.1019
TMT-A	ρ	0.0663	-0.046	-0.061	0.0802	0.0886	0.076	0.165
	p	0.4952	0.6393	0.5329	0.4091	0.362	0.4346	0.0879
TMT-B	ρ	0.0157	0.0747	-0.031	-0.12	0.0488	0.0049	0.0093
	p	0.8715	0.4422	0.7498	0.2143	0.6159	0.9601	0.9238
VFT-1	ρ	-0.042	0.1233	0.0728	0.1301	0.0542	0.1227	0.1659
	p	0.6635	0.2038	0.4542	0.1795	0.5775	0.2059	0.0862
VFT-2	ρ	-0.017	-0.043	-0.126	0.1324	0.0127	-0.019	0.0203
	p	0.8629	0.6577	0.1956	0.1721	0.8963	0.8449	0.8346
Stroop-1	ρ	0.0398	-0.07	0.0326	0.0497	0.0876	-0.031	0.0438
	p	0.6829	0.4721	0.7376	0.6097	0.3674	0.7528	0.6524
Stroop-2	ρ	-0.027	0.0329	0.0276	-0.078	0.0065	0.1718	0.0762
	p	0.7815	0.7357	0.7766	0.4235	0.9465	0.0755	0.4329
Δ Stroop	ρ	-0.056	0.0636	-0.02	-0.093	-0.031	0.2076	0.0726
	p	0.5681	0.5134	0.8355	0.3408	0.7478	0.0311	0.4555

Notes: CW – cognitive domain; MW – mobility; SW – self-care; RW – relationships; LW – daily activities; PW – social activities; WHO – overall score
Source: compiled by the author

Thus, while there were no correlations between the indicators of these methods during the initial examination of the CTBI group, there were no correlations between the indicators of these methods. After the therapeutic intervention, the reduction of cognitive impairment was more pronounced in patients who, before treatment, showed less ability to perceive the holistic structure and features of the drawing copying strategy, and impairment in the field of social activity was more effectively levelled in those who, at the beginning of therapy, had a good ability to inhibit the more naturally strong verbal functions in favour of colour perception.

Spearman's rank correlation coefficient was also calculated for the StroopCWIT, VFT, TMT, and ROCFT, which were used in the initial examination and the 4DSQ test, which was used in the initial and repeated examination (Table 7-9).

Table 7. The relationship between cognitive functioning and the 4DSQ test in the PTSD group at baseline and after therapy

Examination		First					After therapy				
scale		DIS	DEP	ANX	SOM	4DSQ	DIS	DEP	ANX	SOM	4DSQ
ROC-1	ρ	-0.024	0.0419	0.0602	0.0529	0.0577	-0.005	0.0215	0.0249	0.0839	0.0205
	p	0.8025	0.6655	0.5339	0.5849	0.5511	0.9553	0.8247	0.7968	0.3857	0.8322
ROC-2	ρ	-0.008	0.0905	-0.056	0.0113	-0.003	0.0055	-0.101	-0.119	-0.06	-0.096
	p	0.9341	0.3493	0.5636	0.9073	0.9739	0.9547	0.2946	0.2159	0.5376	0.3217
ROC-3	ρ	0.092	-0.123	-0.034	0.0688	0.018	-0.197	-0.046	0.1083	-0.111	-0.095
	p	0.3414	0.2027	0.7288	0.4769	0.8526	0.0401	0.6363	0.2621	0.2488	0.3283
TMT-A	ρ	0.0019	0.0542	-0.005	-0.138	-0.028	0.19	0.1756	0.0505	-0.012	0.1797
	p	0.9847	0.5757	0.9588	0.1513	0.7752	0.0478	0.0678	0.6023	0.8975	0.0616
TMT-B	ρ	-0.134	0.0536	-0.039	0.0005	-0.11	0.0586	-0.013	-0.027	-0.043	0.043
	p	0.1653	0.5802	0.6878	0.9962	0.253	0.5452	0.8963	0.7795	0.66	0.657
VFT-1	ρ	0.0768	-0.163	-0.162	-0.19	-0.124	-0.01	0.0973	-0.01	0.1954	0.0549
	p	0.4272	0.0907	0.0926	0.0477	0.1993	0.9204	0.3142	0.9168	0.0417	0.5711
VFT-2	ρ	0.1538	-0.018	0.0046	0.026	0.1503	0.0234	0.0256	-0.045	0.021	0.0353
	p	0.1102	0.856	0.9621	0.7886	0.1189	0.8092	0.7913	0.643	0.8281	0.7156
Stroop-1	ρ	-0.018	0.0771	-0.036	-0.099	-0.04	0.0159	-0.12	0.073	0.0032	0.0047
	p	0.8565	0.4254	0.7102	0.304	0.6805	0.8693	0.2129	0.4506	0.9736	0.9617
Stroop-2	ρ	-0.037	0.0141	-0.128	0.0782	-0.01	-0.07	0.0177	-0.166	-0.03	-0.138
	p	0.7012	0.8845	0.1859	0.4191	0.9192	0.4681	0.8551	0.0854	0.756	0.1529
Δ Stroop	ρ	-0.018	-0.047	-0.063	0.1159	0.012	-0.081	0.0876	-0.18	-0.003	-0.114
	p	0.8551	0.624	0.5141	0.23	0.9015	0.4042	0.3648	0.0604	0.9746	0.2362

Notes: DIS – distress; DEP – depression; ANX – anxiety; SOM – somatisation; 4DSQ – Four-Dimensional Symptom Questionnairee
Source: compiled by the authors

For the PTSD group (Table 7), during the initial examination, statistically significant correlations were found only between the SOM scale of the 4DSQ and the letter part of the VFT test (ρ=-0.19; p=0.0477). After the therapy, the DIS scale of the 4DSQ had statistically significant correlations with the delayed recall scale of The Ray-Osterrieth Complex Figure Test (ρ=-0.197; p=0.0401) and positive correlations with the indicators of part A of the TMT (ρ=0.19; p=0.0478). In addition, the SOM scale had a significant correlation with the categorical part of the VFT test (ρ=0.1954; p=0.0417). Thus, before the therapy, it was found that greater severity of somatoform disorders occurred in patients with low verbal associative productivity, but after the therapy, the situation changed polarly – it was patients with high verbal associative productivity who showed a greater tendency to somatize psychological conflict by developing somatoform disorders. After the therapy, the symptoms of distress were most effectively reduced in those patients who had well-developed dynamic parameters of attention, the level of voluntary regulation, and visual-motor coordination at the time of treatment.

In representatives of the TBI group (Table 8), at the initial examination, statistically significant negative correlations were observed between the integral somatisation index of the 4DSQ test and the index of the categorical part of the VFT technique (ρ=-0.189; p=0.0465), as well as between the ANX scale and the immediate reproduction scale of the The Ray-Osterrieth Complex Figure Test (ρ=-0.186; p=0.0494). After the therapy, significant correlations were observed only between the scores of the The Ray-Osterrieth Complex Figure Test and the 4DSQ, with the delayed reproduction scale having negative correlations (ρ≥-0.188; p≤0.0468) with the DEP scale and the 4DSQ integral score, and positive correlations between the immediate reproduction scale and the DIS scale of the 4DSQ (ρ=0.2018; p=0.0329).

Table 8. The relationship between cognitive functioning and the 4DSQ test in the TBI group at baseline and after therapy

Examination		First					After therapy				
scale		DIS	DEP	ANX	SOM	4DSQ	DIS	DEP	ANX	SOM	4DSQ
ROC-1	ρ	-0.069	0.1529	-0.186	-0.011	-0.118	-0.069	-0.068	0.0589	-4E-04	-0.025
	p	0.47	0.1076	0.0494	0.9104	0.2135	0.4722	0.4781	0.5372	0.9964	0.793
ROC-2	ρ	0.0413	-0.072	0.1044	-0.018	0.0332	0.2018	-0.033	-0.014	0.1274	0.1553
	p	0.6657	0.4484	0.2734	0.8476	0.728	0.0329	0.7331	0.8842	0.1808	0.102
ROC-3	ρ	-0.048	0.0219	-0.119	-0.031	-0.168	-0.176	-0.188	-0.053	-0.153	-0.286
	p	0.614	0.8186	0.2112	0.7435	0.076	0.0629	0.0468	0.5778	0.1083	0.0022
TMT-A	ρ	-0.008	-0.114	-0.095	-0.039	-0.168	-0.015	-0.006	0.1231	-0.102	0.0553
	p	0.9301	0.2327	0.3216	0.6849	0.0766	0.8723	0.9528	0.1961	0.285	0.5626
TMT-B	ρ	0.074	0.1359	-0.047	-0.02	0.0912	0.0071	0.1428	-0.025	0.1133	0.1085
	p	0.4381	0.1532	0.624	0.8375	0.3387	0.941	0.1332	0.7917	0.2343	0.255
VFT-1	ρ	0.0635	-0.065	-0.079	0.0079	0.0215	-0.04	-0.046	-0.032	-0.052	-0.05
	p	0.5062	0.4931	0.4099	0.9343	0.8218	0.6786	0.6306	0.7351	0.5831	0.6021
VFT-2	ρ	-0.108	-0.024	-0.15	-0.083	-0.189	0.0664	-0.061	-0.062	-0.065	0.01
	p	0.2563	0.8003	0.1144	0.3846	0.0465	0.4864	0.5232	0.5133	0.494	0.9165
Stroop-1	ρ	-0.141	-0.028	0.0299	0.1047	-0.065	0.0956	-0.052	-0.176	0.0001	-0.03
	p	0.1368	0.7702	0.7546	0.2721	0.4945	0.3158	0.5832	0.0628	0.9988	0.7539
Stroop-2	ρ	-0.175	0.0338	0.0455	0.0483	-0.086	-0.066	-0.137	-0.074	5E-05	-0.07
	p	0.0645	0.7237	0.6338	0.6132	0.3677	0.4903	0.1489	0.437	0.9995	0.4624
Δ Stroop	ρ	0.0297	0.0361	0.0487	-0.071	0.0357	-0.135	-0.042	0.12	0.0137	-0.022
	p	0.7557	0.7057	0.6104	0.4573	0.7089	0.1545	0.6606	0.2074	0.886	0.8201

Notes: DIS – distress; DEP – depression; ANX – anxiety; SOM – somatisation; 4DSQ – Four-Dimensional Symptom Questionnaire

Source: compiled by the authors

Thus, at the time of the initial examination, patients with TBI had a more pronounced somatisation of psychological conflict, the less developed their executive function and the smaller their semantic memory. At the same time, after the therapy, these features were levelled out, although a greater degree of somatisation remained in patients with an insufficient ability to perceive the integral structure and features of the visual-manual coping strategy. As opposed to the research groups described above, at the time of the initial survey of the respondents of the CTBI group (Table 9), no correlations were found between the indicators of the techniques under consideration, except for the relationship between the letter part of the VFT test and the ANX scale of the 4DSQ (ρ=0.2295; p=0.0169).

Table 9. The relationship between cognitive functioning and the 4DSQ test in the CTBI group at baseline and after therapy

Examination		First					After therapy				
scale		DIS	DEP	ANX	SOM	4DSQ	DIS	DEP	ANX	SOM	4DSQ
ROC-1	ρ	0.0336	-0.159	0.0867	-0.138	0.036	0.1911	-0.014	0.1807	0.069	0.2481
	p	0.7298	0.0996	0.3721	0.1546	0.7117	0.0575	0.8823	0.0612	0.476	0.0096
ROC-2	ρ	0.1214	-0.01	-0.157	0.027	0.0006	0.0735	-0.089	-0.111	-0.188	-0.064
	p	0.2108	0.9179	0.1046	0.7815	0.9949	0.45	0.3597	0.2548	0.051	0.5101
ROC-3	ρ	0.0822	-0.118	-0.099	-0.024	-0.084	-0.136	-0.11	-0.092	0.123	-0.108
	p	0.3975	0.2236	0.3071	0.805	0.3848	0.1594	0.2556	0.3439	0.206	0.2676
TMT-A	ρ	-0.087	-0.118	0.1197	0.0603	-0.015	-0.042	0.1159	1E-05	0.052	-0.009
	p	0.3679	0.2258	0.2172	0.5351	0.8738	0.6653	0.2324	0.9999	0.594	0.9276
TMT-B	ρ	-0.036	-0.026	0.099	-0.174	-0.015	0.0134	0.0342	-0.048	-0.004	-0.013
	p	0.7105	0.7925	0.3082	0.0719	0.8764	0.8907	0.7256	0.6234	0.964	0.8942
VFT-1	ρ	0.049	-0.109	0.2295	-0.033	0.1465	-0.014	-0.2	-0.126	-0.079	-0.154
	p	0.6148	0.2626	0.0169	0.7319	0.1304	0.8886	0.0379	0.1945	0.414	0.1118
VFT-2	ρ	0.0853	-0.153	0.1719	-0.047	0.1374	-0.14	-0.076	0.0021	0.005	-0.094
	p	0.3799	0.1129	0.0753	0.6273	0.1561	0.148	0.4339	0.9825	0.958	0.3353
Stroop-1	ρ	-0.125	-0.007	0.0024	0.0215	-0.107	0.006	0.0532	0.0238	0.241	0.0735
	p	0.1985	0.9452	0.9802	0.8253	0.2717	0.9511	0.5843	0.8067	0.012	0.4497
Stroop-2	ρ	-0.036	0.0728	0.1452	-0.117	0.0828	-0.096	0.0924	-0.092	-0.063	-0.099
	p	0.7134	0.4541	0.1338	0.2289	0.3944	0.3229	0.3417	0.3448	0.52	0.3091
Δ Stroop	ρ	0.0646	0.0843	0.1431	-0.143	0.1584	-0.027	0.0083	-0.102	-0.194	-0.098
	p	0.5068	0.3857	0.1395	0.1411	0.1015	0.7842	0.9323	0.2952	0.044	0.3146

Notes: DIS – distress; DEP – depression; ANX – anxiety; SOM – somatisation; 4DSQ – Four-Dimensional Symptom Questionnaire

Source: compiled by the authors

When analysing the results of the repeated examination using the 4DSQ test, positive correlations were found between the SOM scale scores and the congruent part, as well as the Stroop stiffness-rigidity test ($\rho \geq -0.194$; $p \leq 0.044$); between the DEP scale and the letter part of the VFT test ($\rho = -0.2$; $p = 0.0379$), as well as positive correlations between the 4DSQ integral index and the ROCFT copying scale ($\rho = 0.2481$; $p = 0.0096$). Thus, in the initial study, somatisation of anxiety symptoms occurred to a greater extent in respondents with low verbal associative performance, which cannot be controversial. After the therapy, patients with CTBI whose associative productivity was, on the contrary, well-developed, more easily got rid of somatized depressive symptoms, and patients who focused mainly on the effects of the word meaning when it did not correspond to a visual impression had better results in getting rid of somatoform disorders.

Thus, this study determined that in different clinical groups, different cognitive characteristics influenced the effectiveness of treatment. PTSD patients had a range of characteristics (high verbal associative performance, developed dynamic parameters of attention, sufficient level of voluntary regulation, and visual-motor coordination). On the contrary, other features of cognitive functioning in patients with PTSD (reduced semantic memory, reduced development of the lexical system and executive functions) in some way impeded recovery during therapy. In patients with TBI, the effective reduction of impairments in self-care, mobility, and daytime activity was influenced by a high level of attention span, working memory, and executive functions, and a higher level of control flexibility. In patients with comorbid PTSD/TBI, individuals with high control flexibility and high associative performance demonstrated a rapid reduction in cognitive impairment during therapy and somatized depressive symptoms.

Existing studies examined various aspects of the psychiatric consequences of TBI in patients with PTSD and their impact on recovery during treatment, but there is no data from Ukrainian scientists whose area of interest is cognitive features in the comorbidity of PTSD and TBI. M.L. Timmer *et al.* [5], investigating the range of long-term behavioural disorders and care provided after traumatic brain injury, indicated that only half of patients resumed work regardless of the severity of the injury, which indicates that the presence, but not the severity of long-term behavioural disorders prevents return to work, which emphasises the importance of early detection and appropriate treatment of behavioural disorders in patients with TBI. This study provided a detailed analysis of the cognitive features that facilitate rehabilitation therapeutic interventions in veterans with comorbidity of TBI and PTSD.

S.M. Lippa *et al.* [4], studying PTSD symptoms associated with cognitive function after TBI, found that the

potential impact of PTSD symptoms on cognitive function should be taken into account in military personnel and veterans with a history of mild/medium TBI. In addition, the authors indicated that the severity of PTSD symptoms should be taken into account to assess cognitive dysfunction in comorbidity with PTSD. The study results were consistent with the results obtained in this paper regarding the impact of the severity of clinical symptoms of PTSD on cognitive dysfunction, but additionally, the impact of TBI symptoms on cognitive functioning and treatment effectiveness was analysed.

A.R. Mayer *et al.* [19], J.B. Patel *et al.* [20] and M.B. Stein *et al.* [21] demonstrated neuroimaging indicators of the combined effect of TBI and PTSD on the white matter of the brain in the form of a larger number of spatially heterogeneous areas of abnormally low fractional anisotropy, or "potholes", which was found in veterans with a history of mild TBI and was not associated with age, time after injury, PTSD, mood disorders or alcohol use with harmful effects [20-22]. However, A.R. Mayer *et al.* [19] described only cases of psychiatric illness that occurred after traumatic brain injury, without considering the different time points of occurrence of these conditions. A.I. Esagoff *et al.* [22] did not conduct a targeted neuropsychological study of cognitive functioning and its impact on the effectiveness of treatment, unlike the present study. N.L. de Souza *et al.* [23] described the neuroimaging and neuropsychological profile only in active military personnel, unlike the present study, which examined veterans and demobilised military personnel.

The results of neuroimaging studies demonstrated that in relatively young veterans with mild TBI, the finding of Deep white matter hyperintensities (DWMH) has a different and negative impact on memory performance than the impact of PTSD symptoms [24-26]. The present study did not use neuroimaging data due to the heterogeneity of the technical features of diagnostic devices and the unstructured nature of general imaging descriptions.

D.L.G. Van Praag *et al.* [27] studied the impact of neurocognitive functioning on the course of PTSD and found that strong sustained attention was associated with improved symptoms of post-traumatic stress disorder, leading to the conclusion that assessing cognitive abilities can help identify individuals at risk of developing (persistent) PTSD after TBI and provide opportunities to inform treatment strategies. However, the present study did not assess the prognostic value of the treatment effectiveness, which was conducted by the authors of this study. Consequently, concurrent PTSD and mTBI should be considered as a risk factor for poor neuropsychological outcome, which requires early and comprehensive intervention.

Conclusions

The study results confirmed the impact of cognitive functioning on the effectiveness of complex therapy for veterans with PTSD and mTBI. The developed dynamic parameters of attention in the PTSD group, a sufficient level of voluntary regulation and visual-motor coordination in individuals with PTSD at the time of treatment, provided effective suppression of symptoms of distress after therapy. On the contrary, the peculiarities of cognitive functioning of patients with PTSD, which in some way hindered, first, the restoration of self-care, were reduced semantic memory, development of the lexical system and executive functions. In addition, well-developed verbal and language functions were associated with less effective reduction of disorders in the field of relationships.

A high attention span, working memory and executive functions in the TBI group predicted the effectiveness of the process of recovery of self-care and daily activities. A higher level of control flexibility in people with TBI was associated with effective mobility recovery. Developed executive function and a smaller semantic memory reserve led to a more pronounced somatisation of symptoms at the beginning of the study, which was effectively levelled after the therapy, although a greater degree of somatisation remained in patients with the insufficient ability to perceive the holistic structure and features of the visual-manual copying strategy.

Reduction of cognitive impairment in the CTBI group was more pronounced in patients who demonstrated impaired perception of the integral structure in copying a picture before treatment, and impairment in social activity was more effectively levelled in individuals with high control flexibility. In addition, individuals with low verbal associative performance at baseline had the highest somatisation of anxiety symptoms. High associative productivity provided for an effective reduction, firstly, of somatized depressive symptoms, and high control flexibility led to better results in getting rid of somatoform disorders.

A detailed study and analysis of cognitive indicators is promising for clinical practice, as it is necessary to determine the scope of medical and psychotherapeutic interventions for comorbidity of PTSD and TBI and to predict the effectiveness of therapy. Further research should consider the development of an individual approach to the treatment of patients with PTSD and coexisting mild TBI, tailored to their cognitive status.

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Conflict of Interest

There are no potential sources of conflict of interest that affect the author's objectivity.

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Вплив когнітивного функціонування на ефективність лікування ветеранів з посттравматичним стресовим розладом та легкою черепно-мозковою травмою

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Анотація. Анамнез щодо травматичного ушкодження мозку у ветеранів пов'язаний з більшим використанням послуг охорони психічного здоров'я, незалежно від виставлених психіатричних діагнозів, що робить актуальним розробку комплексного підходу до лікування та оцінки його ефективності. Метою роботи було дослідити вплив особливостей когнітивного функціонування серед 329 ветеранів з коморбідними посттравматичним стресовим розладом та легкою черепно-мозковою травмою на ефективність комбінованої терапії. Для дослідження когнітивного функціонування проводились: тест Рея-Остерріца, тест зв'язку символів, тест Струпа, тест вербальної швидкості. Оцінка функціонування проводилась за опитувальником Всесвітньої організації охорони здоров'я для оцінки інвалідизації. Ефективність комбінованої терапії також оцінювалась за Чотиривимірним опитувальником симптомів. Підтверджено вплив когнітивного функціонування на ефективність 8-тижневої комплексної терапії ветеранів з вказаною коморбідністю. Показники тесту зв'язку символів мали статистично значущі негативні кореляційні зв'язки з показником шкали когнітивної сфери ($\rho = -0{,}237$; $p = 0{,}0117$) та інтегральним показником опитувальника Всесвітньої організації охорони здоров'я для оцінки інвалідизації ($\rho = -0{,}192$; $p = 0{,}0424$), а також позитивні кореляційні зв'язки з шкалами самообслуговування ($\rho = 0{,}2038$; $p = 0{,}0311$) та денної активності ($\rho = 0{,}2048$; $p = 0{,}0303$). Виявлено, що пацієнти з посттравматичним стресовим розладом, легкою черепно-мозковою травмою та їх коморбідністю по-різному реагували на проведення терапії, що визначалось клінічними особливостями їх когнітивних процесів, а саме асоціативної продуктивності, ригідності/гнучкості контролю, уваги, робочої пам'яті та виконавчої функції. Динаміка когнітивного функціонування відрізнялась у кожній групі. Також встановлено, що когнітивні симптоми ставали мішенями терапії, про що свідчила їх редукція після проведеного втручання. Отримані дані дозволять більш ефективно та комплексно організовувати надання спеціалізованої психіатричної допомоги ветеранам, а когнітивне функціонування має прогностичне значення щодо ефективності та тривалості лікування

Ключові слова: психічний розлад, пов'язаний зі стресом; травма мозку; когнітивні розлади; виконавчі функції; лікування; ветерани; коморбідність