

Cognitive functioning of a patient with herpes simplex virus encephalitis – a case study. An exemplary paper for the State Examination in the field of clinical psychology – neuropsychology

Funkcjonowanie poznawcze pacjentki z opryszczkowym zapaleniem mózgu – opis przypadku.

Praca przykładowa do egzaminu państwowego z zakresu psychologii klinicznej – neuropsychologii

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Abstract

This paper is an example of a case report for a state examination in the field of clinical psychology – neuropsychology. The case report was used during the examination in 2023 and received a positive rating. Its publication is an attempt to respond to the still reported difficulties in accessing exemplary works of this type. Due to publication limitations, some elements of the description have been shortened. The article can also be treated as a case study on the cognitive functioning of a person with active herpes encephalitis. Both screening scales, such as Addenbrooke's Cognitive Examination III and Frenchay Aphasia Screening Test, as well as other scales to measure individual cognitive functions were used in order to assess the patient.

Keywords: cognitive functions, neuropsychology, clinical psychology, herpes simplex virus encephalitis

Streszczenie

Artykuł stanowi przykład opisu przypadku do egzaminu państwowego z zakresu psychologii klinicznej – neuropsychologii. Prezentowany opis został wykorzystany i pozytywnie oceniony w trakcie egzaminu w 2023 roku. Publikacja jest próbą odpowiedzi na nadal zgłaszane trudności w dostępie do przykładowych prac. Ze względu na ograniczenia związane z publikacją skrócono niektóre elementy opisu. Artykuł może być również traktowany jako *case study* na temat funkcjonowania poznawczego osoby z aktywnym opryszczkowym zapaleniem mózgu. Do oceny stanu pacjentki posłużyły zarówno skale przesiewowe, takie jak Addenbrooke's Cognitive Examination III oraz Frenchay Aphasia Screening Test, jak i inne skale oceniające poszczególne funkcje poznawcze.

Słowa kluczowe: funkcje poznawcze, neuropsychologia, psychologia kliniczna, opryszczkowe zapalenie mózgu

BACKGROUND, RESEARCH CONTEXT AND DOCUMENTATION ANALYSIS

A 40-year-old female patient was admitted to a specialist hospital due to fever accompanied by hypotension and confusion. During transport in an ambulance (emergency medical team, EMT), a seizure with eye deviation to the right side was observed. Another seizure occurred in the hospital emergency room. Due to her health condition, the patient was admitted to the department of neurology with stroke subunit. In the initial period of the illness, speech impairment in the form of mixed sensorimotor aphasia of variable severity (moderate/severe) occurred, which began to resolve with treatment. In the weeks preceding hospitalisation, the patient was on holiday abroad and began to feel unwell towards the end of her stay. She developed skin blisters (most likely herpes simplex) around her mouth.

During hospital stay, extensive diagnosis was conducted to identify the aetiology of the disease and choose appropriate treatment strategy. A non-contrast computed tomography (CT) of the head performed on day 3 of hospital stay showed “an extensive hypodense area in the left hemisphere, involving the temporal lobe, (to a smaller extent) the frontal and occipital lobes, and the subcortical nuclei, as well as displacement of the ventricular system to the right by approximately 5 mm, calcifications in the subcortical nuclei (mainly right) and a pineal cyst (5 × 7 mm)”. CT angiography (CTA) showed no cerebrovascular pathologies. Electroencephalography (EEG) with stroboscopic stimulation on day 4 of hospital stay showed the dominance of drowsiness. On day 22 of hospital stay, contrast-enhanced magnetic resonance imaging (MRI) of the head showed “oedematous lesions in the left temporal lobe, more severe medially and around the pole, areas of marginal annular enhancement with segmental thickening of the meninges adjacent to the largest oedematous lesions along the Sylvian fissure and along the cavernous sinus, with slightly restricted diffusion with a possible tendency to create purulent lesions or abscesses during therapy. The image corresponded to meningoencephalitis, most likely due to HSV (herpes simplex virus) infection. The ventricular system had normal width, was slightly narrower on the side of the oedematous lesions, and displaced to the right by up to 4.5 mm supratentorially”. Contrast-enhanced brain MRI on day 30 of hospital stay revealed “a picture similar to the previous examination, except for a reduced shift of the ventricular system to approximately 3 mm and minor haemorrhagic conversion of inflammatory lesions in the left temporal lobe (in the pole and in the posteroinferior part)”.

Based on the above data, as well as cerebrospinal fluid analysis, the diagnosis of herpes meningoencephalitis was established and appropriate treatment was implemented.

The presented assessment was performed at the request of the attending physician one month after the patient's admission to the department of neurology in order to determine

the severity of dysfunctions and the deficit profile. Four diagnostic appointments were arranged. The patient gave consent to participate in assessments and for her case to be described as part of specialisation in clinical psychology.

DATA FROM OBSERVATION AND CLINICAL INTERVIEW

During the appointments, the patient established logical verbal contact, although she experienced slight difficulties with updating words in spontaneous speech, sometimes without compensation, and there were sporadic instances of paraphasia (mainly semantic). She communicated with appropriate prosody. The patient's affect was mostly correctly modulated; she presented with even mood, lively facial expression, and slightly increased drive. She periodically shortened the distance during conversations and willingly cooperated with the psychologist.

The patient lives with her husband and two school-age sons. She has higher technical education. She has no history of chronic treatment. Until falling ill, the woman was professionally active, held a managerial position and performed a job requiring high cognitive skills. Despite an opportunity to work in a hybrid mode (she partially worked from home), she was exposed to stressful situations due to her responsible position. The patient reported that she liked and wished to resume her job after the recovery period. She is motivated to continue rehabilitation, and is engaged in both physical and cognitive therapy (including speech) during her hospital stay. The patient shows trust in medical personnel. Although she was not fully critical of her health condition at the beginning of her illness (she said that she would leave the hospital in three days when she got better), now she agrees to undergo all the necessary tests and long-term treatment as “she knows she could have died”.

According to her husband's account, the patient was “difficult to communicate with” and placed so much focus on her professional duties that she had tended to neglect sleep or regular meals before the illness. She had no hobbies or interests outside of work. Her husband described her as “stubborn” and often very direct towards other people, which sometimes caused them discomfort. He also reported that his wife was characterised by excessive rigidity in her approach to duties in the premonitory period, e.g. she did the vacuuming every morning, regardless of whether it was necessary. She was responsible for paying bills, shopping, taking care of children, and cooking. She was very energetic and sometimes “did something before thinking”. She not always drew conclusions from her mistakes. She willingly established and maintained contacts with people and has several good friends to rely on for support. According to her husband, she has not shown any tendency to worry or shown any episodes of depressed mood.

Just before falling ill, the woman was on vacation in Greece with her friends. It was then that she developed extensive cold sores. After returning home, the patient felt fine and went

to work. The following weekend she was outside when the air temperature exceeded 35°C. On Monday morning, she called her husband and said she was feeling so bad that she was unable to rise from the bed. An ambulance was called. After the arrival of EMT, the patient was assessed and administered a drip infusion, after which improvement was noted. Both the husband and the patient thought it might have been “heatstroke”. However, the patient’s condition began to deteriorate on Tuesday. She complained of a very severe headache and began to have problems with speaking. EMT was called again and the patient was transported to the hospital. During the patient’s stay in the hospital, the husband observed a gradual yet evident improvement in her functioning. He reported that speaking difficulties in the form of problems with recalling words (at the beginning, the patient misspelled words or used words that were inappropriate in a given context) were still present. The patient also tended to repeat the same information to her husband several times a day, not remembering that she has already done so. In terms of emotional and personality functioning, the patient’s husband observed that she was slightly more attentive and reserved in contacts with other people compared to the premorbid period. He also noted that his wife seemed increasingly aware of the risk associated with her illness and the need to take a break from work. He was not certain whether she would be able to cope with household chores in the present functional state. Together they plan to give her time to rest and continue rehabilitation.

SPECIFICITY OF THE USE OF RESEARCH DATA IN A CASE DESCRIPTION IN A SELECTED SUB-SPECIALISATION OF CLINICAL PSYCHOLOGY

The presented case study is an example of a specialised psychological diagnosis, i.e. neuropsychological diagnosis. Its aim is both to identify deficit areas, such as cognitive and emotional dysfunctions or behavioural disorders, as well as to demonstrate resources (including social ones) and aspects of functioning that are well preserved and may contribute to patient’s improvement. Since the neuropsychological diagnosis assesses a full spectrum of everyday functioning, it can be referred to as a functional diagnosis. In the described case, data collected during hospital stay may suggest cognitive, behavioural and emotional deficits. Therefore, an attempt was made to find out whether the patient met the criteria of cognitive, emotional and behavioural functioning consistent with the above diagnoses, which somewhat gives the study the character of a nosological diagnosis. An analysis of data collected during interview and medical records was used for inference purposes. An attempt was also made to analyse quantitative results and, to a greater extent, qualitative data obtained in experimental and clinical tests. Taking into account the above, this case study is of a mixed clinical/psychometric nature.

CLINICAL/PSYCHOLOGICAL PROBLEM (PSYCHOLOGICAL PERSPECTIVE)

Cognitive deficits due to herpes simplex virus encephalitis (HSVE) represent the clinical problem in the described case. Infection with herpes simplex virus (most often HSV-1 responsible for herpes labialis, less often HSV-2 causing genital herpes, especially in immunocompromised patients) is one of the most common etiological factors of sporadic viral encephalitis affecting about 2–4 people per million (Tedyanto et al., 2021). HSV is very common, with anti-HSV-1 antibodies found in approximately 50–90% of the adult population, depending on socioeconomic conditions. Although HSV-1 encephalitis can occur at any age, more than half of cases are over 20 years of age. Infection of the central nervous system (CNS) most often occurs through reactivation of latent virus, which enters the CNS either through bloodstream or neurons (olfactory and trigeminal nerve fibres). HPV has an affinity for brain structures such as the temporal lobes and the limbic system (amygdala, hippocampus, insula, olfactory cortex, cingulate gyrus), and, to a lesser extent, for the orbital part of the frontal lobes. Necrotic, haemorrhagic and oedematous lesions in the affected brain centres are most often described in post-mortem studies (Szcudlik et al., 2004).

HSVE is usually relatively severe with many non-specific symptoms, including headache (81%), fever (90%), impaired consciousness (97%), personality disorders (85%) ranging from withdrawal to agitation with hallucinations, paresis (38%), cranial nerve dysfunction (32%), meningeal symptoms, and generalised or focal epileptic seizures (67%). Some patients experience non-specific prodromal symptoms, such as upper respiratory tract infection (Singh et al., 2016). Consciousness disorders worsen within a few hours to a few days. Focal neurological symptoms also occur. Subacute or chronic course is relatively rare, and the disease may last up to several months. If left untreated, HSVE is fatal in 70–80% of cases (Rowland and Pedley, 2012). Involvement of the temporal lobes and their connections results in aphasic speech disorders, as well as memory and behavioural disorders (confusion, hallucinations, agitation). Symptoms resulting from the involvement of the frontal lobes, such as the loss of initiative or behaviour inappropriate to the situation, are less common. Due to behavioural disorders and personality changes, HSVE is sometimes confused with psychiatric symptoms, which translates into a significant delay in appropriate treatment (Tedyanto et al., 2021).

In terms of cognitive functions, memory disorders (short-term, verbal episodic and semantic) and language dysfunctions, as well as executive and visuospatial deficits are usually observed (in approximately 70% of patients). Behavioural disorders are seen in almost half of the patients (45%), while aphasia affects 40% of those infected (Szcudlik et al., 2004). As for language functions, patients

with lesions located mainly in the left hemisphere show amnesic aphasia-like deficits in the form of difficulty updating words in spontaneous speech and impaired confrontational naming (Soares-Ishigaki et al., 2012). These patients also present with significant memory loss, covering both the pre- and postmorbidity period. In the initial phase of HSVE, patients are often unable to remember the reason for hospital stay and the place of their current stay; the first days of hospitalisation may remain permanently amnesiac, while other cognitive functions and general intellectual performance remain intact (Laurent et al., 1991). Approximately 78% of patients experience improvement in cognitive functions after the acute phase of the disease, while approximately 13% develop dementia 4 years after the onset of infection (Szcudlik et al., 2004). Due to the relatively young age at disease onset in some patients, cognitive dysfunctions (memory and language dysfunctions in particular) may pose a significant difficulty in resuming work (Kapur et al., 1994).

AIM, RESEARCH QUESTIONS AND HYPOTHESES

The aim of the study was to assess cognitive functioning (identify dysfunctional domains, as well as the profile and severity of deficits) and the emotional state of the patient.

Research questions:

1. Does the patient experience cognitive impairment?
2. Does the patient experience deficits typical of herpes encephalitis?
3. Does the patient experience cognitive deficits other than those typical of herpes encephalitis?
4. Does the patient experience emotional-behavioural dysfunctions?

Research hypotheses:

1. The patient experiences cognitive impairment.
2. The experienced cognitive deficits are typical of herpes encephalitis.
3. The patient shows no cognitive deficits other than those typical of herpes encephalitis.
4. The patient experiences emotional-behavioural dysfunctions.

RESEARCH METHODS

- Interview.
- Observation.
- Experimental and psychometric tests:
 - Addenbrooke's Cognitive Examination III (ACE-III) (Mathuranath et al., 2000; Noone, 2015; Sitek et al., 2017) – a screening tool to measure cognitive functions; contains tests to assess attention, memory, verbal fluency, visuospatial and language functions;
 - Frenchay Aphasia Screening Test (FAST) (Enderby et al., 1987) – a screening test to assess the presence of aphasic speech disorders;

- Arizona Semantic Test (Beeson, unpublished; <https://aphasia.sites.arizona.edu/content/8>) – a non-verbal test containing four response options with varying degrees of semantic connection with the source stimulus; in addition to the correct answer, these are three distracting options, partially related either semantically or visually, but not related in any way to the source stimulus (Antonucci et al., 2008);
- Right Hemisphere Language Battery (RHLB-PL) (Łojek, 2007) – a set of tests to assess cognitive dysfunctions commonly observed in left hemisphere damage (linguistic and abstract thinking dysfunctions in particular);
- Boston Naming Test (BNT) (Kaplan et al., 2001) – a test assessing confrontational naming skills;
- Rey Auditory Verbal Learning Test (RAVLT) (Schmidt, 1996) – a test assessing the patient's ability to learn, extract and recognise (persistence of memory trace);
- Nonverbal Learning and Memory Test Revised (Diagnostikum für Cerebralschädigung – II, DCS-II) (Weidlich et al., 2011) – a tool to assess learning of visuospatial material;
- Rey-Osterrieth Complex Figure (ROCF) (Shin et al., 2006) – a test assessing construction praxis and involuntary visual memory;
- Attention and Perceptiveness Tests (APT; Testy Uwagi i Spostrzegawczości, TUS) (Ciechanowicz and Stańczak, 2006) – a set of tests assessing psychomotor speed, visual field search capabilities and visual attention selectivity; the sheet and norms for a 6/9 sample were used;
- Trail Making Test Part A, Part B, TMT A, TMT B (Bowie and Harvey, 2006) – a tool to assess attention (both attention maintenance and switching) and executive functions: working memory, reaction inhibition, error control;
- Stroop Color and Word Test, SCWT (Stroop, 1935 – 1992) – a clinical test assessing executive functions, e.g. susceptibility to interference;
- Frontal Assessment Battery (FAB) (Dubois et al., 2000) – a tool to assess executive functions;
- Beck Depression Inventory (BDI) (Beck et al., 1961) – a tool to assess depressive symptoms;
- Coping Inventory for Stressful Situations, CISS (Enderly and Parker, 1994) – a questionnaire to assess stress coping styles;
- State-Trait Anxiety Inventory (STAI) (Wrześniewski et al., 2011) – a tool to assess the severity of anxiety symptoms perceived as a state and a trait;
- Eysenck Personality Questionnaire Revised (EPQ-R) (Eysenck et al., 1985; Jaworowska, 2011) – a test to assess personality variables;
- experimental tests to assess calculia and finger gnosis, ideomotor, alternating, spatial and dynamic praxis, pose (clinical experimental tests – based on, among other things, *A set of tests to examine cognitive processes in patients with brain damage* by Włodzimierz Łucki) (Łucki, 1995).

DESCRIPTION OF TEST RESULTS

Tabs. 1–4 show the results of tests conducted to assess the patient's cognitive, emotional and personality functioning. In the case of tools that take into account confidence intervals, a value of 85% was assumed.

Experimental tests to assess calculia and finger gnosis, ideomotor, alternating, spatial and dynamic praxis, and pose were performed correctly.

Screening results

The screening of cognitive performance (total ACE-III score) suggested deficits in cognitive functions; therefore, a decision was made to extend the assessment with detailed tests for individual cognitive domains.

Mnestic functions

The assessment of mnestic functions involved determining orientation in terms of place, time and oneself, the use of RAVLT, DCS-II and memory ACE-III subtests, as well as delayed reproduction of Rey's Complex Figure. The auto- and allopsychological orientation was fully preserved. Lower results were observed for learning processes (the patient was unable to learn all verbal and non-verbal items, with a plateau learning curve for verbal material), short- and long-term memory retrieval, and involuntary visual memory (delayed reproduction of Rey's Complex Figure). Recognition of memorised items (ACE-III and RAVLT trials) was also impaired relative to results expected for age and education. The patient performed better in the domain of non-verbal memory.

Visuospatial functions

The assessment was conducted using a copy of the Rey's Complex Figure, ACE-III subtests, and a clock drawing test. The results and qualitative assessment of the tests performed indicated no visuospatial deficits.

Language functions

Language functions, including spontaneous speech, were assessed using the ACE-III subtests, FAST and Arizona Semantic Test. The patient correctly identified the items named by the examiner and repeated vowels, syllables, words and sentences. She correctly performed the reading tests. In the writing tests (spontaneous, dictation and copying), a single paraphasia appeared. FAST revealed no aphasic speech disorders. However, there were slight difficulties in updating words during spontaneous speech and more pronounced deficits in confrontational naming, e.g. in BNT. It is worth emphasising that the Arizona Semantic Test did not suggest any difficulties in associating the meaning of non-verbal material, which indicates

Screening of cognitive functions (ACE-III)	
Subtest	Scores
Attention	17/18
Memory	19/26
Fluence	10/14 (words starting with "k": 16 + 1 repetitions; animals: 12 + 2 repetitions; additionally words starting with "o": 11 + 4 repetitions and 1 proper name; vegetables and fruit: 14)
Language	16/26
Visuospatial skills	16/16
Total score	78/100
Clock drawing test (as part of ACE-III)	Correct
ACE-III – Addenbrooke's Cognitive Examination III.	

Tab. 1. Screening of cognitive functions

Assessment of language functions	
Tool	Score
FAST	27/30
Arizona Semantic Test	38/40
Boston Naming Test	9/15
RHLB	
Subtest	Sten scores
Inference	10
Lexical Semantic	10
Humour	5
Comments	2
Picture Metaphor	6
Written Metaphor	10
Picture Metaphor Explanation	5
Written Metaphor Explanation	6
Emotional Prosody	8
Linguistic Prosody	7
Discourse Analysis	6
Total score	7
FAST – Frenchay Aphasia Screening Test; RHLB-PL – Right Hemisphere Language Battery.	

Tab. 2. Assessment of language functions and RHLB scores

relatively well-preserved knowledge (semantic memory). In the case of ACE-III semantic memory test, the patient was unable to independently recall the names of the indicated persons (except for the Pope), but she correctly selected the names from the list. When assessing language functions, some RHLB-PL subtests were also taken into account: the patient scored above average in Reasoning, the Written Metaphors Test and the Lexical-Semantic Test, which may indicate relatively well-preserved skills in reading comprehension and abstract thinking, as well as knowledge about objects in the case of written material. The remaining RHLB results were within the norm, except for the Comments Test, the performance of which, however, should be attributed mainly to executive dysfunctions or emotional and personality factors (according to interview data).

Test	Score
RAVLT	
Learning	5, 8, 8, 10, 8
Delayed recall	4/15
Recognition	24/30
DCS-II	
Learning efficiency index	Stens 3–4
Error index	Stens 3–4
Additionally: delayed	8/9
Additionally: recognition	18/18
ROCF	
Copy	36/36
Reproduction	16/36
TMT	
TMT A	38 s
TMT B	62 s
TUS	
Stens	3.
Quartile	I
Executive functions	
SCWT	22 s/47 s
FAB	17/18
RAVLT – Rey Auditory Verbal Learning Test; DCS-II – Diagnosticum für Cerebralschädigung; ROCF – Rey–Osterrieth Complex Figure; TMT A – Trail Making Test Part A; TMT B – Trail Making Test Part B; APT – Attention and Perceptiveness Tests (6/9 test); SCWT – Stroop Color and Word Test; FAB – Frontal Assessment Battery.	

Tab. 3. The results of other test to assess cognitive functions

Tool	Score
BDI	7
CISS – sten scores	
Task-oriented coping (TOC)	Stens 4–6
Emotion-oriented coping (EOC)	Stens 4–6
Avoidance-oriented coping (AOC)	Stens 8–10
Distraction (D)	Stens 7–9
Social diversion (SD)	Stens 6–10
STAI – sten scores	
Anxiety as a state	Stens 3–5
Anxiety as a trait	Stens 1–3
EPQ-R – sten scores	
Psychoticism (P)	Stens 3–7
Extraversion (E)	Stens 5–8
Neuroticism (N)	Stens 1–2
Lie (L)	Stens 5–8
Addiction (A)	Stens 1–3
Criminality (C)	Stens 1–3
BDI – Beck Depression Inventory; CISS – Coping Inventory for Stressful Situations; STAI – State-Trait Anxiety Inventory; EPQ-R – Eysenck Personality Questionnaire Revised.	

Tab. 4. The results of tests assessing emotional and personality aspects

Attention

ACE-III, TMT A and B, as well as TUS were used to assess attention. The patient's scores were within normal limits in terms of visual attention selectivity. There was no delay in TMT B in terms of attention switching. The reduced speed of visual field search may have been partially due to the patient's fatigue.

Executive functions

Since executive functions control overall cognitive functioning, they were assessed throughout the study. In particular, FAB and SCWT scores, learning curve from the RAVLT test, TMT B subtest and RHLB subtests, as well as experimental and clinical tests (explanation of repeated proverbs in ACE-III) were taken into account. The results indicate relatively well-preserved executive functions. Abstract thinking, shifting attention and relatively good inhibition of automatic reactions were also preserved. However, a reduced ability to learn verbal material and a tendency to shorten the distance, visible during interactions with the patient, were observed. It remains consistent, among others, with the score obtained in the RHLB Comments Test. Semantic-lexical searching and working memory were found to be impaired, which was evident in fluency tests (phonemic fluency in particular).

Praxis and gnosis

No deficits were found in experimental or clinical praxis tests. No visual gnosis disorders were noted during the assessment.

Emotional and personality functioning

Neither the patient's behaviour nor the results of psychometric tests indicated the presence of depressive or anxiety symptoms. Despite the CISS scores suggesting a tendency to use an avoidance-oriented coping strategy, the patient willingly and persistently participated in all meetings with the psychologist and mainly presented the task-oriented style. As for personality, she scored moderately/high for extraversion and low for neuroticism, which corresponded to her premorbid functioning. As already mentioned, there was a clear tendency to shorten the distance when performing the tests, which may, however, have resulted from her premorbid emotional and behavioural functioning. No behaviours inappropriate to the study situation were noted.

VERIFICATION OF HYPOTHESES

1. The patient experiences cognitive dysfunctions

The test results indicate the presence of cognitive deficits, mainly in memory (encoding, extraction and persistence of memory traces for verbal material) and linguistic functions

(confrontational naming in particular). Attention (searching through the visual field) and executive functions (response inhibition, working memory) were less impaired. Considering the norms, results for age and education, and the estimated level of the patient's premorbid functioning, the hypothesis on the presence of cognitive disorders may be accepted.

2. The cognitive deficits are typical of herpes encephalitis

According to medical history, the patient showed no signs of cognitive impairment in her everyday life prior to hospitalisation. The symptoms appeared only after developing HSVE. During the initial period of hospital stay, confusion and speech disorders in the form of mixed sensorimotor aphasia were observed. Seizures also occurred. One month after admission, mnemonic functions (most evident in tests using auditory-verbal material) and linguistic functions (confrontational naming), as well as less severe deficits in attention and executive functions prevailed in the deficit profile. No disturbances of visuospatial functions, gnosis, praxis, lexis or graphia were detected. Due to the rare occurrence of HSVE in the general population, literature data on the cognitive functioning of patients with HSVE from studies in large samples are missing. However, the available data show that the symptoms mentioned above are part of the picture of cognitive deficits often seen in HSVE (Rowland and Pedley, 2012; Szczudlik et al., 2004; Tedyanto et al., 2021). The profile of language dysfunctions, which are mainly amnesic in nature, is also consistent with literature data (Soares-Ishigaki et al., 2012). Furthermore, the described deficits correspond to MRI changes located primarily in the temporal areas of the left hemisphere. The above arguments confirm the hypothesis that the patient's dysfunction profile is consistent with the deficits typical of HSVE.

3. The patient experiences no cognitive deficits other than those typical of herpes encephalitis

Herpes encephalitis, which spreads in the CNS, can give rise to a wide spectrum of cognitive manifestations: from confusion, through linguistic, mnemonic, visuospatial and executive deficits, to behavioural disorders (Rowland and Pedley, 2012). However, there are no literature data indicating the presence of praxis and gnosis deficits in HSVE. Before hospital stay, the patient did not show any behaviour suggesting cognitive deficits. During the hospital stay, linguistic and mnemonic dysfunctions and, to a lesser extent, executive and attentional dysfunctions were mainly observed. Gnosis and praxis dysfunctions, which could indicate the presence of cognitive disorders other than those typically seen in HSVE, were not observed. The course of the disease itself was also consistent with changes typical of HSVE. Given the lack of deficits untypical of HSVE, the absence of premorbid dysfunctions, and, above all, symptoms fitting in

the broad spectrum of HSVE, the hypothesis that the patient did not develop deficits other than those typical of HSVE can be accepted.

4. The patient experiences emotional and behavioural dysfunctions

The patient showed no signs of emotional or behavioural dysfunctions. Despite the observed discreet tendency to shorten the distance, the patient's husband reported that it may be related to her premorbid emotional and behavioural functioning. The data obtained from the family indicates that the patient became more distant during hospital stay compared to the premorbid period. Therefore, the hypothesis on emotional and behavioural dysfunctions cannot be clearly confirmed.

DETERMINATION OF PSYCHOLOGICAL MECHANISMS UNDERLYING DISORDERS BASED ON PSYCHOLOGICAL THEORIES

The described deficits, including mnemonic dysfunctions with auditory and verbal material, amnesic language functions (anomic features), as well as attentional and executive functions, seem consistent with CNS changes detected in MRI. As a result of the disease, the patient experienced extensive hypodense damage in the left hemisphere, in the temporal lobe and, to a lesser extent, in the frontal and occipital lobes and the subcortical nuclei of the brain. Also, displacement of the ventricular system to the right was observed. Temporal MRI changes (located mainly medially) could be related to dysfunctions in verbal memory (memory trace consolidation in particular). Naming disorders, mostly without signs of semantic deficits, could have resulted from changes in the mid-posterior temporal lobe of the dominant hemisphere; they had features of amnesic aphasia according to Benson's classification (Benson and Ardila, 1996). Executive and attentional dysfunctions can be attributed to lesions in the left frontal lobe and subcortical nuclei. In turn, the relatively low score in the RHLB Comments Test could be related to the shift of the ventricular system and compression of the right hemisphere, as well as damage to the frontal areas and subcortical structures (Herzyk, 2015). The described cognitive dysfunctions are consistent with neuroimaging data, and at the same time fit into the picture of cognitive disorders observed in HSVE (according to literature).

PATIENT'S AND HER IMMEDIATE SOCIAL ENVIRONMENT RESOURCES, PROGNOSIS

Well-preserved cognitive functioning in visuospatial construction, praxis and gnosis may be considered patient's resources. Deficit areas, i.e. mnemonic, executive and attentional functions, are only slightly impaired and do not seem to significantly affect the patient's daily functioning during her stay in the department of neurology. Language deficits

do not impede effective communication with other people. The patient is still able to perform basic everyday activities independently, without supervision or assistance. She had been professionally active until the disease and, as she points out, she wishes to resume her work after the convalescence period. The patient is highly motivated to continue rehabilitation and plans rehabilitative activities after returning home. Mnestic, attentional and executive dysfunctions can make work in a given position challenging. However, considering the progress in rehabilitation observed so far, the patient's age, the estimated baseline potential and the high level of motivation, returning to the previous level of cognitive functioning is highly likely if neuropsychological therapy and patient's efforts are continued. Furthermore, the patient can rely on her family, friends and colleagues for support after discharge. She therefore has resources that will allow for relatively good functioning after returning to her place of residence. Due to her young age and the nature of the disease, a follow-up of the dynamics of changes in cognitive functioning is recommended.

SUGGESTIONS FOR INTERVENTION AND/OR PSYCHOLOGICAL THERAPY

Cognitive therapy is recommended to improve cognitive functions. Even if the expected outcomes in the form of a full recovery of premorbid functioning are not achieved, such therapy may contribute to significant improvement, allowing for resuming professional work. Neuropsychological rehabilitation should target deficit areas, i.e. mnestic and executive dysfunctions, attention disorders and language deficits, as well as well-preserved areas that may help accelerate and enhance the effects of pro-cognitive training.

OTHER RECOMMENDATIONS

Further outpatient care (neuropsychological and neurological) and follow-up neuropsychological examination in 3–6 months are recommended in order to monitor the symptoms. This is also necessary due to the increased risk of dementia in patients after HSVE (Szcudlik et al., 2004). In the event of sudden worsening of cognitive and/or neurological symptoms, immediate contact with EMT is advised.

Conflict of interest

The author reports no financial or personal relationships with other individuals or organisations that could adversely affect the content of the publication and claim ownership of this publication.

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Author contributions

Original concept of study; collection, recording and/or compilation of data; analysis and interpretation of data; writing of manuscript; critical review of manuscript; final approval of manuscript: DAZ.

References

- Antonucci SM, Beeson PM, Labiner DM et al.: Lexical retrieval and semantic knowledge in patients with left inferior temporal lobe lesions. *Aphasiology* 2008; 22: 281–304.
- Beck AT, Ward CH, Mendelson M et al.: An inventory for measuring depression. *Arch Gen Psychiatry* 1961; 4: 561–571.
- Benson DF, Ardila A: *Aphasia: A Clinical Perspective*. Oxford University Press, New York 1996.
- Bowie CR, Harvey PD: Administration and interpretation of the Trail Making Test. *Nat Protoc* 2006; 1: 2277–2281.
- Ciechanowicz A, Stańczak J: *TUS – Testy Uwagi i Spostrzegawczości. Podręcznik. Pracownia Testów Psychologicznych Polskiego Towarzystwa Psychologicznego, Warszawa 2006.*
- Dubois B, Slachevsky A, Litvan I et al.: The FAB: a Frontal Assessment Battery at bedside. *Neurology* 2000; 55: 1621–1626.
- Enderby PM, Wood VA, Wade DT et al.: The Frenchay Aphasia Screening Test: a short, simple test for aphasia appropriate for non-specialists. *Int Rehabil Med* 1987; 8: 166–170.
- Endler NS, Parker JDA: Assessment of multidimensional coping: task, emotion, and avoidance strategies. *Psychol Assess* 1994; 6: 50–60.
- Eysenck SGB, Eysenck HJ, Barrett P: A revised version of the Psychoticism scale. *Pers Individ Dif* 1985; 6: 21–29.
- Herzyk A: *Wprowadzenie do neuropsychologii klinicznej*. Wydawnictwo Naukowe Scholar, Warszawa 2015.
- Jaworowska A: *Kwestionariusze osobowości Eysencka EPQ-R oraz EPQ-R w wersji skróconej. Polskie normalizacje. Pracownia Testów Psychologicznych Polskiego Towarzystwa Psychologicznego, Warszawa 2011.*
- Kaplan E, Goodglass H, Weintraub S: *Boston Naming Test (BNT)*. APA PsycTests, 2001.
- Kapur N, Barker S, Burrows EH et al.: Herpes simplex encephalitis: long term magnetic resonance imaging and neuropsychological profile. *J Neurol Neurosurg Psychiatry* 1994; 57: 1334–1342.
- Laurent B, Allegri RF, Thomas-Anterion C et al.: Long term neuropsychological follow-up in patients with herpes simplex encephalitis and predominantly left-sided lesions. *Behav Neurol* 1991; 4: 211–224.
- Łojek E: *Bateria Testów do Badania Funkcji Językowych i Komunikacyjnych Prawej Półkuli Mózgu (RHLB-PL)*. Podręcznik. Pracownia Testów Psychologicznych Polskiego Towarzystwa Psychologicznego, Warszawa 2007.
- Łucki W: *Zestaw prób do badania procesów poznawczych u pacjentów z uszkodzeniami mózgu*. Podręcznik. Pracownia Testów Psychologicznych Polskiego Towarzystwa Psychologicznego, Warszawa 1995.
- Mathuranath PS, Nestor PJ, Berrios GE et al.: A brief cognitive test battery to differentiate Alzheimer's disease and frontotemporal dementia. *Neurology* 2000; 55: 1613–1620.
- Noone P: Addenbrooke's Cognitive Examination-III. *Occup Med (Lond)* 2015; 65: 418–420.
- Rowland LP, Pedley TA: *Neurologia Merritta*. Vol. 1, 3rd ed., Urban & Partner, Wrocław 2012: 184–186.
- Schmidt M: *Rey Auditory Verbal Learning Test: A Handbook*. Vol. 17, Western Psychological Services, Los Angeles, CA 1996.
- Shin MS, Park SY, Park SR et al.: Clinical and empirical applications of the Rey-Osterrieth Complex Figure Test. *Nat Protoc* 2006; 1: 892–899.
- Singh TD, Fugate JE, Hocker S et al.: Predictors of outcome in HSV encephalitis. *J Neurol* 2016; 263: 277–289.
- Sitek EJ, Barczak A, Senderecka M: Zastosowanie jakościowej analizy profilu wykonania skali ACE-III w diagnostyce różnicowej chorób otepiennych. *Aktualn Neurol* 2017; 17: 34–41.
- Soares-Ishigaki ECS, Cera ML, Pieri A et al.: Aphasia and herpes virus encephalitis: a case study. *Sao Paulo Med J* 2012; 130: 336–341.

- Stroop JR: Studies of interference in serial verbal reactions. *J Exp Psychol Gen* 1992; 121: 15–23.
- Szczudlik A, Liberski PP, Barcikowska M (eds.): *Otępienie*. Wydawnictwo Uniwersytetu Jagiellońskiego, Kraków 2004.
- Tedyanto EH, Susilawathi NM, Indradewi AAAS: Herpes simplex virus encephalitis: a literature review. *Ro J Neurol* 2021; 20: 438–447.
- Weidlich S, Derouiche A, Hartje W: *DCS-II: Diagnosticum für Cerebralschädigung – II: Ein figuraler visueller Lern- und Gedächtnistest nach F. Hillers*. Huber, 2011.
- Wrześniewski K, Sosnowski T, Jaworowska A et al.: *Inwentarz Stanu i Cechy Lęku*. Polska adaptacja STAI. Pracownia Testów Psychologicznych Polskiego Towarzystwa Psychologicznego, Warszawa 2011.