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The dynamics of the image of linguistic, cognitive, and socio-emotional disorders in case of a patient after a craniocerebral trauma

SUMMARY

The consequences of the post-traumatic brain injuries are characterized by diversity and dynamics of pathological symptoms, which include: disturbances of vegetative functions, limitations of motor functions, disorders of speech as well as other cognitive activities, difficulties with socio-emotional functioning. Additional neurological complications, such as epilepsy, can additionally influence the clinical condition of the patient. The aim of this work was the assessment of the socio-emotional functioning of the man after a craniocerebral trauma over the four-year period after the accident. The first test was conducted in the first year of recovery (in the eighth month after the trauma) and the second in the following three years. In the scientific research procedure selected neuropsychological tests as well as experimental clinical trials were used to assess the linguistic activities. The obtained results demonstrated the occurrence of persisting symptoms of dynamic motor aphasia and mild cognitive disorders. During the three-year period, despite the systematic therapy, only a slight improvement of memory processes was identified with a clear decline of functioning in the socio-cultural context.

Key words: craniocerebral trauma, disorders of cognitive processes, dynamic motor aphasia, socio-emotional disorders

INTRODUCTION

The neuropsychological and neurologopedic assessment of individuals after traffic accidents with regard to the diversity of occurring cognitive, linguistic, and socio-emotional impairments requires an accurate recognition of mechanism governing the functioning of a human being. A multidimensional and systematic

therapy of individuals after craniocerebral traumas triggers compensatory mechanisms and the improvement of cognitive and socio-emotional functioning. However, a human being, as a biological entity embedded in a social context, frequently possesses inadequate immunological resources in comparison to the requirements of the environment. Therefore, the process of recovery ought to be considered from a broader holistic and functional perspective – not only as a restoration of the lost abilities, but also as a mutual relationship which occurs between the biological processes of a human being as well as between an entity and the environment.

This article addresses the issue of the dynamics of functioning of a patient with dynamic motor aphasia over the course of a four-year period after the occurrence of the neurological incident. The method of a case study in the perspective of longitudinal data enables to describe the long-term consequences of a craniocerebral trauma.

THE SPECIFICITY OF A CRANIOCEREBRAL TRAUMA

Traumatic brain injury (TBI), for example craniocerebral trauma, belongs to the most frequent reasons of death and permanent disability in case of individuals under 45 years of age (Fisher, Phillips 2006, after: Morris 2014). It develops as a result of a sudden mechanical force acting upon the head with the force exceeding the adaptation capabilities of the cranium and meninges which leads to changes in functioning of the central nervous system resulting from either an injury of brain structure or functional impairments connected with the disruption of chemical and electrical homeostasis in the brain (Pąchalska 2007). In literature it is highlighted that due to significant differences in brain and cognitive reserves, a similar injury can lead to moderate problems in case of some individuals and to total disability in case of others (Stern 2002).

Craniocerebral traumas are characterized by multifold neurological consequences. As a result, it may lead to the impairment of various sense and movement functions as well as functions of the autonomic nervous system which usually results in long-lasting consequences, such as motor impairments, epileptic seizures, headaches, vision impairment, and sleep disorders (Morris 2014).

Clinical and neuropsychological consequences of craniocerebral trauma can be divided into:

1. Primary – occurring at the moment when the force is acting upon the cranium;
2. Secondary – intracranial complications with varying mechanisms and developing at a different pace. It is possible to distinguish: intracerebral hematomas, cerebral ischemia, cerebral oedema, injury of the nerve fibers, membrane of nerve cells, and the cell body of nerve cells themselves;

3. Long-term – these occur a couple of months after the injury. They most often acquire the shape of sets of symptoms, sets of signs, or sets of symptoms and signs (Kądzielawa 2003; Pąchalska 2007).

It is estimated that in case of approximately 60% of patients after craniocerebral traumas there occur cognitive impairments of different character and strength. Even when it comes to mild brain injuries in case of 43% of patients there appear neuropsychological deficits (Bendictus, after: Roessler-Górecka et al. 2003). For the patient the cognitive impairments occurring as a result of brain dysfunctions become the main barrier to unaided functioning through renewed adjustment to life in society. Typical signs include: the impairment of executive functions and attention, memory as well as learning, and speech (McAllister 2009). Apart from cognitive deficits, the most frequent outcomes of traffic accidents include affective disorders, social impairments as well as the failure to perform the previous social roles. What is important is that craniocerebral trauma influences the patient's quality of life in a long-term and significant way. Craniocerebral trauma has a greater influence on the psychosocial factors rather than on the general somatic state of the patients, which reflects the cumulative impact of the trauma on the entirety of human functioning. In case of more than 80% of patients with brain injuries, emotional and behavioural problems had a significant influence on the functioning of the whole family (Jaracz, Kozubski 2008). On the one hand, the patient's surroundings are a vital source of support as well as a buffer for negative outcomes of stress and traumatic events. On the other hand, lack of co-operation from the family may contribute to the delay or even to the disruption of the recovery process (Laskowska et al. 2005).

The findings show that patients with a craniocerebral trauma display a tendency to underestimate the actual problems or, quite the contrary, to exaggerate. In case of numerous patients, the image of the impairments becomes blurred also due to the tendency to diminish the difficulties with functioning which they experienced before the accident and to connect all of the current problems with the injury (Rossler-Górecka et al. 2013). The changes in the structure of personality manifested by impulsiveness, irritability, affective instability, lack of insight, and apathy are common in case of individuals after a craniocerebral trauma. They might acquire the shape of escalating traits from before the accident or principal changes in behavioral patterns (McAllister 2008).

The main emotional disorders occurring as a consequence of the organic dysfunction of the brain include both affective symptoms: anxiety, excitement, arousal, emotional disinhibition, states of euphoria, mania as well as passive symptoms: lack of spontaneity, psychomotor retardation, lack of interest in the surroundings, increased fatigability, apathy, and depression. The patients may also present sings of egocentrism, emotional liability, negative attitude to reality, lack of empathy, and verbosity (Laskowska et al. 2005).

The spectrum of cognitive, emotional, and behavioural signs and symptoms occurring after brain injuries is extremely wide. Due to the complex character of pathomechanisms as well as the brain functions themselves, their influence on the functioning of a patient after a neurological incident is difficulty to assess.

THE CLINICAL CHARACTERISTICS OF THE PATIENT

A 33-year-old male who suffered a craniocerebral trauma as a result of a traffic accident was analyzed. The patient's psychophysical state before the accident was assessed as good. The analyzed male completed tertiary education and was raised in a complete family. Before the traffic incident he had been successfully performing numerous social roles.

The head injury resulted in fractures of facial skeleton, hematomas in both frontal lobes and left parietal lobe, subdural hemorrhage, cerebral oedema, left-sided pneumothorax and severe respiratory failure as well as calcaneal fracture of the right foot. Left-sided hemiparesis occurred as well. During a few months' hospitalization the patient was diagnosed with depressive syndrome – mood depression, sadness, pessimism, slower movements, and a decrease of intellectual efficiency. After three months from the accident there occurred tonic-clonic epileptic seizures. The continuous post-traumatic epilepsy manifests itself in seizures with or without the loss of consciousness. After a seizure partial right-sided hemiparesis reoccurs.

Once the patient's clinical state had been stabilized, he underwent clinical, psychological, neurologopedic, and occupational therapy. As a result of a logopedic examination, the patient was diagnosed with signs of speech impairment which can be classified within the spectrum of dynamic motor aphasia. The mechanism of speech impairments concerns both the programming of developed utterances - internal speech deficit - and the production of linguistic units at the segmental (phone) and suprasegmental (prosodic) levels.

The patient's wife, sisters, and parents constitute a vital system of social support**.** The patient tries to be self-reliant in his attempts to take care of himself. However, he is not able to become a fully independent individual. His decision not to seek professional work is motivated by epileptic seizures. Until recently he was an active volunteer working for the media. Currently, a significant exacerbation of apathy and adynamia can be observed.

THE EMPLOYED SCIENTIFIC METHODS

Diagnostic tests were conducted in the Department of Logopedics and Applied Linguistics at MCSU in Lublin[1]. The patient was twice subject to a research procedure: in January 2012 as well as after a three-year period in January 2015. The diagnosis took place during the weekly meetings with the patient. The following psychometric tools were employed:

1. The Mini-Mental State Examination (MMSE) – a clinical screening test which helps to assess the mental state of a patient (Kotapka-Minc 2007);
2. The Attention and Perceptiveness Test (*Test Uwagi i Spostrzegawczości* – TUS) – version 3/8 which comprises of an exercise during which the patient has to cross particular shapes out of other similar shapes (Ciechanowicz, Stańczak 2006);
3. The California Verbal Learning Test (CVLT) – which is employed in order to measure the ability to learn and memorize the verbal material (Łojek, Stańczak 2010);
4. The Ruff Figural Fluency Test (RFFT) which measures the non-verbal fluency understood as the ability to create new patterns within a time limit (Łojek, Stańczak 2005);
5. The Social Competence Questionnaire (*Kwestionariusz Kompetencji Społecznych* – KKS) – which allows to assess social competence understood as acquired skills determining the effectiveness of human functioning in different social situations (Matczak 2001);

Additionally, the patient was twice subject to experimental clinical trials in order to assess the narrative abilities which included i. a. the presentation of one's biography. The utterances were qualitatively analyzed with a focus on the cognitive and linguistic facets.

Research results

The results of the conducted psychological tests and experimental clinical trial are presented below. The first performed task included the Mini-Mental State Examination which is a screening tool allowing to diagnose the first signs of dementia.

[1] The patient remains the patient of the University Laboratory of the Department of Logopedics and Applied Linguistics at MCSU in Lublin, where he has been undergoing a systematic neurologopedic therapy conducted by volunteers – students of logopedics and audiology – under the mentoring of Ph. D. Jolanta Panasiuk for the past four years. The patient was twice subject to a research procedure: in January 2012 as well as after a three-year period in January 2015.

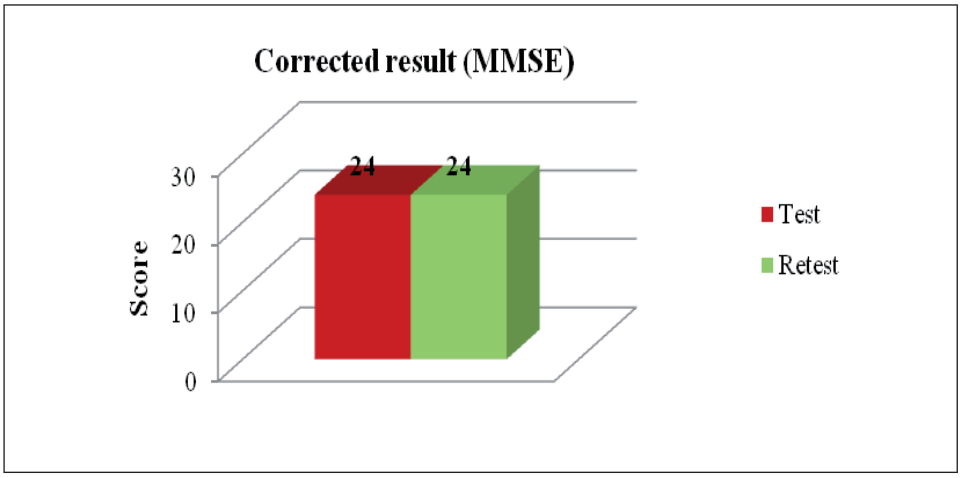

Fig. 1. Test results of the Mini-Mental State Examination[2]

The data included in the chart may indicate the continuing mild cognitive impairment (MCI). The criteria needed to diagnose MCI (Albert et al. 2011, after: Talarowska et al. 2011) seem to be appropriate for the analyzed patient: he does not function properly, yet he was not diagnosed with dementia. Instead, the signs of impairment of cognitive functioning occur continuously, while the patient maintains the ability to perform everyday life activities. The performance of complex instrumental activities is maintained or minimally impaired.

Table 1 presents the results of the Attention and Perceptiveness Test (*Test Uwagi i Spostrzegawczości* – TUS):

Table 1. The results of the Attention and Perceptiveness Test (TUS) version 3/8

TUS index	Test	Retest
Processing speed (stens)	4	4
Number of errors (percents)	6	93
Number of omissions (quartiles)	3	3

In the Attention and Perceptiveness Test it is possible to notice the tendency of the scores to remain at the same level throughout the years. In case of the speed index of perceptual work, the patient obtained an average score with a tendency

[2] The red bars present the patient's results obtained during the test conducted in January 2012, whereas the green bars present the patient's results obtained during the test conducted in January 2015.

to low scores both in the test and the retest. It means that the patient browses the perceptual material at a fairly slow pace. When it comes to the fallibility of perception, that is the occurring errors, the first test proved the rather weakly developed ability to differentiate between various types of visual material. After three years, the patient obtained a better result. What is more, the ability to discern vital stimuli – the fallibility of perception index – functions better in case of only a quarter of individuals of the same age in comparison to the analyzed patient. The result remains at the same level after a three-year period from the first test.

Chart 3 presents the results of the California Verbal Learning Test, and more precisely the indices connected with Reconstructing.

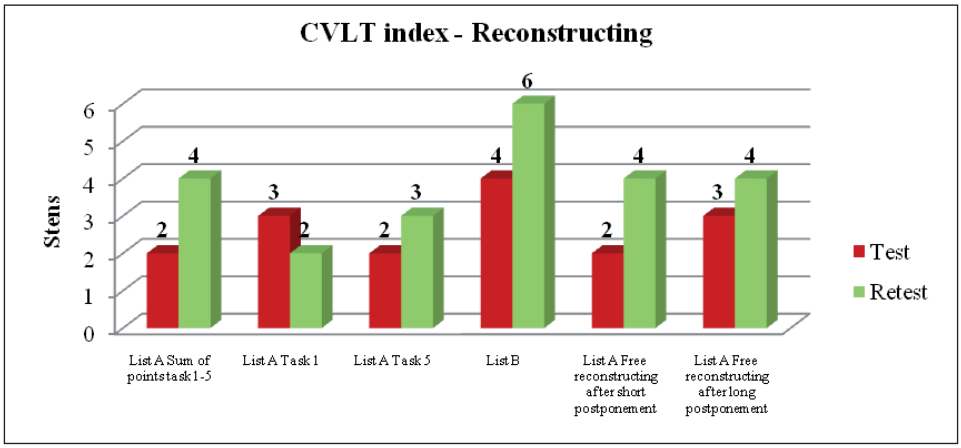

Fig. 2. The results of the California Verbal Learning Test

In the California Verbal Learning Test the patient obtained diversified scores. Most of them were within the low and average score ranges. In the previous test the patient's scores reflected the occurrence of significant problems with short-term memory of verbal material as well as low effectiveness of the process of learning from the presented stimuli. The results obtained during the retest indicated the increased capacity of working memory. Learning effectiveness had a better outcome during the retest rather than the first test, even though these are still scores from the low score range.

During the first performed task, the analyzed patient presented a relatively low resistance to interferential influence of the newly learned material. The consecutive test brought better results indicating higher than average abilities to store the memorized material and high resistance to the interferential influence of the newly learned information. It is possible to observe a minimal progress within the scope of both short- and long-term memory, as the patient improved his scores from low to lower than average.

To sum up, the scores obtained by the patient during the two tests reflect a progress within the scope of increased capacity of short-term verbal memory and more effective memorizing strategy. Working memory and long-term memory are currently at an average level.

The next tool employed in the diagnosis of the patient's cognitive processes was the Ruff Figural Fluency Test (RFFT). A comparison of results obtained during the test and the retest is presented below.

Table 2. The results of the Ruff Figural Fluency Test (RFFT)

RFFT index	Test	Retest
Unique designs (tens)	29	36
Unique designs (centiles)	2	8
Error ratio	>16	>16
Enumerative strategies	3	0
Rotational strategies	0	0

The designs and connections made by the patient in the Ruff Figural Fluency Test (RFFT) display a significant level of accuracy, yet low productivity. The patient displays continuous difficulties with planning, self-control processes, and monitoring of one's behaviour which reflect deficits within the scope of executive functions. These are typical for the damage of prefrontal structures (Stuss 2009). The dysfunctions co-occur with low figural fluency as well as with the deficit of strategies used during the creation of connections and designs. During the first test the patient was using enumerative strategies which helped him to organize planning connected with non-verbal material. During the second performance of this task the patient did not implement any type of strategies.

Another psychometric method checking the patient's self-descriptive functioning in social situations is the Social Competence Questionnaire (*Kwestionariusz Kompetencji Społecznej – KKS*). The results obtained by the patient in connection with particular indices are presented by the following chart:

During the first test the patient obtained a score indicating an average level of intensity of competence determining the effectiveness of actions in intimate situations, an average level of competence in situations requiring assertiveness as well as an average level of the effectiveness of actions in social exposition situations. The general result indicates a low level of the patient's social competence. For comparison, during the retest the analyzed man also obtained low results withing the scope of competence determining the effectiveness in intimate situations, social exposition as well as general social competence. Only the social competence

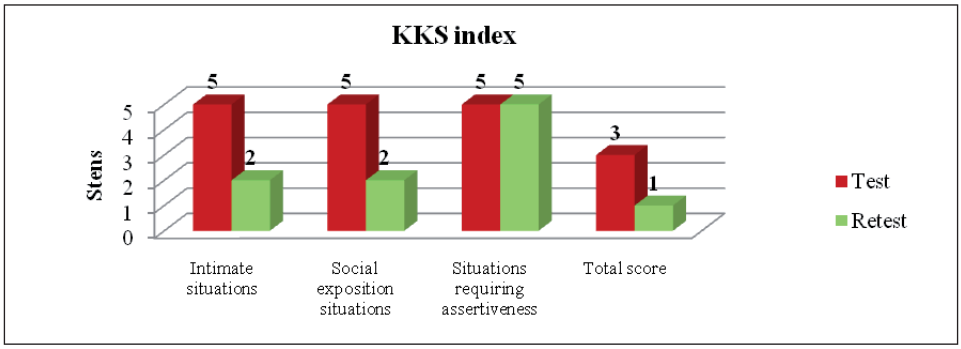

Fig. 3. The results of the Social Competence Questionnaire

occurring in situations requiring assertiveness can be located at the same initial average level.

By confronting the obtained results with the data from an interview with the patient, or his family, it is possible to assert that the subjective image of the patient's own social abilities was significantly overstated by the man in the past. He was assessing his communication abilities as well as social competence inadequately. Currently, owing to the systematic psychotherapy, the patient is able to objectively assess his abilities and deficits. He is surely characterized by a greater insight and self-reflection than three years ago. Notwithstanding this fact, it is possible to observe a significant deterioration of patient's functioning in social relations.

An experimental clinical trial – the patient's utterance concerning a subject of emotional importance, a biography, is an addition to the description of the patient's functioning.

Narration test: Emotional test – biography.

Test:

– Please, present your biography.
– *(The patient remains silent)*
– Where should a biography begin?
– *From the date of birth. Well, I was born on 15 November 1977 in Jarosław. And what else... (Pause).*
– What else should be included in a biography? Generally: when were you born?; what was your education path?; where did you go to work?; when did you get married? etc.
– *(The patient remains silent)*
– All right, you were born on 15 November 1977 in Jarosław.
– *Mmm...I finished school... (Pause).*
– Elementary school?

– *No... preschool!*

– All right, in what year... or when you were...

– *...when I was 5. And then elementary school in Kraśnik. And it was Księdza Piotra Ściegiennego.*

– Im. Księdza Piotra Ściegiennego (Elementary School named after Piotr Ściegienny, a Catholic priest), right?

– *Right.*

– And later which high school did you attend?

– *I attended a comprehensive high school also in Kraśnik, science class. And it was im. Księdza... no... I've confused everything.*

– Im. Księdza Piotra Ściegiennego – it was a high school. Right?

– *Right.*

– What did you do after high school?

– *After high school... after high school I started university education at WSW Wrocławska Szkoła Wyższa (The University of Wrocław) and... my faculty was international relations... (Pause).*

– Were these full-time, part-time, or extramural studies?

– *Extramural... undergraduate studies. Then... (Pause).*

– When you finished international relations with the bachelor's degree you...?

– *I... directly started attending graduate studies and... then during my first year I had a break in my education and I went abroad. In fact, there were different stories connected with my trip... (Pause).*

– And did you manage to finish your studies?

– *I finished graduate studies but I did not defend my Master's thesis. And that is how I finished everything, bit by bit.**

Retest:

– Please, present your biography.

– (*The patient remains silent*)

– Where should a biography begin?

– *From my work.*

– From the beginning. What happened at the beginning of your life?

– *At the beginning I was born (laughter). I attended elementary school – first a preschool – but then elementary school, then I attended high school for four years, then a university – for three years. I earned the bachelor's degree and then I attended graduate studies and... in the so-called meantime I was working, working in two places – in two countries: in the Netherlands and in Poland. And then the time came for television, where I had my internship in the department of technical support and music and then my work connected with a website. At*

the end I dealt only with taking photos and making... films and I started my own business activity, which lasted for 4 months, and... an accident happened (Pause). I don't know, what are interests? And I don't know, what are abilities?

– It doesn't have to be like in a CV but rather it should be a biography – events in your life. We were talking about the accident. What happened later?

– *Later there was rehabilitation and it has been continuing until today and probably it will last my whole life. And that's it.**

*The proper names and some of the autobiographical facts were changed on purpose by the author of the article.

The patient's narrative abilities occurring while telling a biography are limited probably due to the co-occurring cognitive impairments. The first utterance acquires the structure of a dialogue and not a monologue. During the retest it is possible to isolate a longer fragment of an utterance, which has got a narrative character. Without a prior motivation and steering of the conversation with questions the patient is unable to create a narrative utterance. He ponders for a longer period of time and loses the thread, therefore the utterance lacks fluency and additional questions are essential to the further interaction. In both tests it is possible to discern incoherence, the components of the utterance are not organized according to a temporal pattern, and the patient does not present his life by using a linear structure. It is possible to observe significant propensity to digressions.

The analysis of the previous test of narrative ability revealed significant impairments at the level of syntax and lexis. It is possible to discern a strengthening of particular characteristics of idiolectic syntax, for example the excessive use of particular type of conjunctions (*and*). The modifications of grammar patterns of a sentence structure include hardening of the pattern (decreasing the number of possibilities occurring in the norm), looseness of the pattern (loss of sensitivity to the introduction of new elements which are irrelevant when the norm is taken into consideration) as well as gaps in the pattern (omission of important facets accepted in the norm) (Panasiuk 2001).

The patient has difficulties with planning of a longer utterance – confusing of autobiographical threads can indicate certain deficits of episodic memory. During the retest the patient is able to recreate the structures of the biography without additional questions provided by the interviewer. In the second test an improvement of narrative abilities is visible. The characteristic elements occurring in patient's utterances are the sequences of sentences which are linked together. However, the monologue is characterized by lack of fluency.

To sum up, it is possible to assert that the reason for the presented problems appearing as an inability to build a developed utterance is probably the im-

pairment of internal speech as well as the limitation of the predicative abilities (Łuria 1976).

CONCLUSIONS

By comparing the patient's functioning after a couple of months from the craniocerebral trauma and after a three-year recuperation and rehabilitation period it is possible to observe a certain improvement of functioning when it comes to working memory, long-term memory, and the effectiveness of learning. The patient's attention processes remain on the same level with regard to the speed of perceptual work and the fallibility of perception. It is possible to discern a slightly better ability to differentiate between various types of visual material.

Despite the intensive neurologopedic and neuropsychological therapy, it is still possible to observe difficulties with planning, self-control processes, and monitoring of one's behavior which reflect the co-occurrence of deficits within the scope of executive functions. It ought to be highlighted that during the performance of complex tasks an interaction between the processes of frontal lobes and the processes governed by the rear part of the brain occurs (Stuss 2009). The lack of awareness of viable abilities, inadequate overall assessment of the situation, and a weak ability to adjust the actions to the continuously changing environment lead to non-effective interactions with the surroundings (Kaczmarek 2008).

The mechanism of speech impairments results from deficits of internal speech. The patient was considered to suffer from dynamic motor aphasia. The basic sign of aphasic impairments is the inability to create a longer narrative utterance. Additionally, impairments of communicative abilities are connected with the decrease of activity, purposefulness, and intentionality. These changes are a component of hypodynamia, which is the limitation of general psychic and motor activity.

The observable signs of mild cognitive impairment (MCI) can predispose the patient to the occurrence of dementia. Widespread areas of brain damage noticeable in a neuroimaging test (left parietal lobe, left and right frontal lobes) with the co-occurring post-traumatic epilepsy indicate the whole-brain character of cognitive dysfunctions.

The impairments of social functioning are reflected in the self-assessment of social competence. Despite social support, emotional impairments, which are appropriate for frontal lobe disorder, contributed to the deterioration of the patient's activity. Long-term hospitalization, the multitude of rehabilitation activities, and the recurring epileptic seizures negatively influence the man's functioning, as he primarily exists in the role of a patient. His current activity is mostly based on the participation in various types of therapies: logopedic, psychological, movement, and psychotherapeutic.

The outcomes of a craniocerebral trauma ought to be treated as a dynamic phenomenon. The diagnosis and therapy of the patient ought to include the evolutive character of the craniocerebral trauma, which is a condition for the appropriate choice and thus for the effectiveness of therapeutic actions (Morris 2014). The therapeutic activities ought to be an addition to the patient's everyday life and not the foundation of his existence. The priority of rehabilitation in case of brain injuries is to activate the patient within the socio-emotional, cognitive, and communicative spheres.

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