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Zaburzenia narządu ruchu u kobiet w zespole Turnera

Musculoskeletal disturbances in women with Turner's syndrome

Analiza potencjalnych czynników ryzyka syndromu wypalenia zawodowego u fizjoterapeutów

The analysis of potential risks factors for professional burnout syndrome in physiotherapists

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nr 2/2015 (15)

Zastosowanie stymulacji polisensorycznej i wzorców globalnych w przypadku ciężkiego uszkodzenia czaszkowo-mózgowego

Application of the Polysensory Stimulation and the General Movement Patterns in Patients with the Serious Traumatic Brain Injury

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Streszczenie:

Wstęp. Urazy czaszkowo-mózgowe stanowią jedną z głównych przyczyn inwalidztwa oraz śmierci dzieci. Ich konsekwencją są zaburzenia sprawności motorycznej oraz dysfunkcje neuropsychologiczne. Stan taki szczególnie wymaga ograniczenia efektów jatrogennych.
Cel pracy. Celem pracy jest przedstawienie programu rehabilitacji pacjenta po ciężkim urazie czaszkowo-mózgowym.
Studium przypadku. Chłopiec lat 15 w wyniku wypadku komunikacyjnego doznał ciężkiego urazu ogólnego, oraz czaszkowo-mózgowego. Głęboko nieprzytomny, ocena w skali Glasgow – 4 pkt. Poddawany rehabilitacji przez okres 2 miesięcy w warunkach szpitalnych. Stosowano stymulację polisensoryczną, elementy metod: Vojty, NDT-Bobath, PNF, Castillo-Morales oraz Kinesiology taping. Uzyskano znacznego stopnia samodzielność łącznie z osiągnięciem chodu z niewielką pomocą.
Dyskusja. W przeciągu kilkunastu lat pojawiło się wiele prac dotyczących postępowania fizjoterapeutycznego chorych po urazach czaszkowo-mózgowych. Coraz częściej skuteczność procesu usprawniania warunkuje optymalnie wcześnie rozpoczęte i właściwie ukierunkowane leczenie usprawniające. Mimo to w piśmiennictwie obserwuje się znikomą liczbę opracowań sformalizowanych metod wczesnego postępowania. Stąd zachodzi potrzeba opracowania optymalnych zasad postępowania fizjoterapeutycznego.
Wnioski. Najważniejszym elementem postępowania terapeutycznego pacjentów po urazie czaszkowo-mózgowym jest interdyscyplinarna rehabilitacja w oparciu o stosowanie stymulacji polisensorycznej i globalnych wzorców ruchu, łączenia technik różnych metod. Programowanie postępowania fizjoterapeutycznego powinno opierać się na podstawowych zasadach dotyczących ciągłości, kompleksowości, systematyczności, a przede wszystkim wczesności rehabilitacji. Umiejętne postępowanie fizjoterapeutyczne odgrywa istotną role w przywróceniu funkcji poznawczo-emocjonalnych oraz w uzyskaniu optymalnego poziomu sprawności psychoruchowej.

Słowa kluczowe:

uraz czaszkowo-mózgowy, postępowanie fizjoterapeutyczne, stymulacja polisensoryczna, wzorce globalne

Abstract

Introduction. Traumatic brain injuries are among the major causes of disabilities and deaths in children. They cause motor performance disorders and neuropsychological dysfunctions. All the above require the maximum reduction of any iatrogenic effects.
Goal. The goal of this paper is to present a rehabilitation program for the patient after severe traumatic brain injury.
Case Study. As the result of a traffic accident, the 15 years old boy had suffered a severe overall trauma, including the traumatic brain injury. He was deeply unconscious, his score in the Glasgow Coma Scale – 4 points. The patient had undergone a 2 months rehabilitation program, while hospitalized. The polysensory stimulation and elements of the following methods had been applied: Vojta method (Reflex locomotion), NDT-Bobath, PNF, Castillo-Morales and Kinesiology Taping. A high degree of the patient's self-reliance had been achieved, including the ability to walk, with only a slight support.
Discussion. Within the recent – dozen or so – years, numerous studies regarding the physiotherapy treatment in patients with the traumatic brain injury have been published. More often than not, success of the rehabilitation process depends on the early start and the proper orientation of the rehabilitation treatment. Still, in available research, there is very few studies dedicated to the formalized early treatment methods. Hence the need to define the best possible physiotherapy procedures.
Conclusions. The most important issue in the physiotherapy treatment, in patients after the traumatic brain injury, is the interdisciplinary rehabilitation, based on the polysensory stimulation and on the general movement patterns, which combines the techniques of the various methods. Planning of a physiotherapy program should be founded on the basic principles of continuity, comprehensiveness and regularity, but most of all – on the early start of the rehabilitation process. The competent physiotherapy treatment plays an important role in restoration of the cognitive-emotional functions and an achievement of the optimum level of the patient's psychomotor performance.

Key words:

traumatic brain injury, craniocerebral injury, physiotherapy treatment, polysensory stimulation, general movement patterns

Introduction

The traumatic brain injuries are being considered one of the most common causes of death, they come third, after the cardiovascular diseases and cancer [1]. Among young population, they are one of the major causes of disabilities and death. The head injuries, according to statistics, constitute some 50-80% of all injuries [2]. Both, in Poland and worldwide, traumatic brain injuries in children occur frequently. In Poland, they usually take place when the child is left alone, with no adult supervision. The number of traumatic brain injuries in children has been noted to grow during the spring and summer seasons [3]. Twice more frequently they occur in male than in female population. Usually they are the result of a traffic accident, but may also be caused by a fall from a height, violent beating, accidents at home [3, 4, 5]. Traumatic brain injuries do have an impact on the injured person's quality of life. In addition to the primary lesions, such as: skull bone brakes, soft tissue of the head damages, they also cause the intracranial hematomas and the neurological or psychiatric disorders [3, 6]. Those symptoms may occur both, at the post-traumatic (early) stage and much later on [7, 8].

Head injuries cause the motor performance disorders, which can be observed as the abnormal muscle tension, pathological reflexes, limited joints mobility. The injured persons often show the cognitive, communication or emotional dysfunctions as well [6, 9].

In the long term physiotherapy treatment, the main contribution to the traumatic brain injury patients' recovery is the brain plasticity stimulation and, the related, reduction of the neurologic deficit. Neurobiology science, and the development of the neurorehabilitation techniques, indicate the significant role of the neuroplasticity and its ability to compensate for the central nervous system damages. It is believed, that the brain areas, not damaged by the injury, have the ability to take over functions of the damaged structures. It has been proven that the neurons are able to create the new protrusions and synapses in both, the immature and mature central nervous systems. The absence of certain types of the synaptic boutons stimulates creation of the new terminals, both axon and synaptic. Progress of this compensation process depends on the damaged structure's stage of development, complication level of the dysfunction, and if the given function occurs in other, separate structures of the nervous system. The extent of the compensation is also determined by the scale, location and nature of the damage and by the time elapsed since the injury occurred [7, 8, 10, 11, 12].

The authors of this paper have noticed, that the kinesiotherapeutic techniques used in the medical treatment of severe traumatic brain injuries, do not seem efficient. In search for the physiotherapy program solutions, the authors had began observation of the results of a mix of different neurophysiology methods application: PNF, NDT-Bobath, and especially the Vojta method, while emphasizing the irradiation process and the proprioceptive stimulation of the muscle spindles.

Goal

The goal of this work is to present the recovery program for the patient after severe traumatic brain injury, which has been implemented at the Provincial Specialist Hospital for Children in Kielce.

Case Study

Due to the major overall trauma, and especially to the traumatic brain injury, the 15 years old boy had been admitted on 03.08.2014 to the Anesthesiology and Intensive Care Unit of the Provincial Specialist Hospital for Children in Kielce. The patient was deeply unconscious, in the Glasgow Coma Scale his score was 4 points.

Diagnosis

Diffuse TBI damage (concussion of the cerebral hemispheres, intracranial hematoma in the right brain hemisphere). Traumatic subdural hemorrhage over the right brain hemisphere – condition after the craniotomy and the hematoma removal, with the bone flap not replaced. Cerebral endema with herniation in the right temporal-occipital-frontal area. Skull bone fracture. Nose bones fracture. Pulmonary contusion. Traumatic pneumothorax on the right side. Fractures of the first and second ribs on the right side. Central respiratory failure, tracheotomy. Intra skull trauma with the long period of unconsciousness. (Fig. 1, 2).

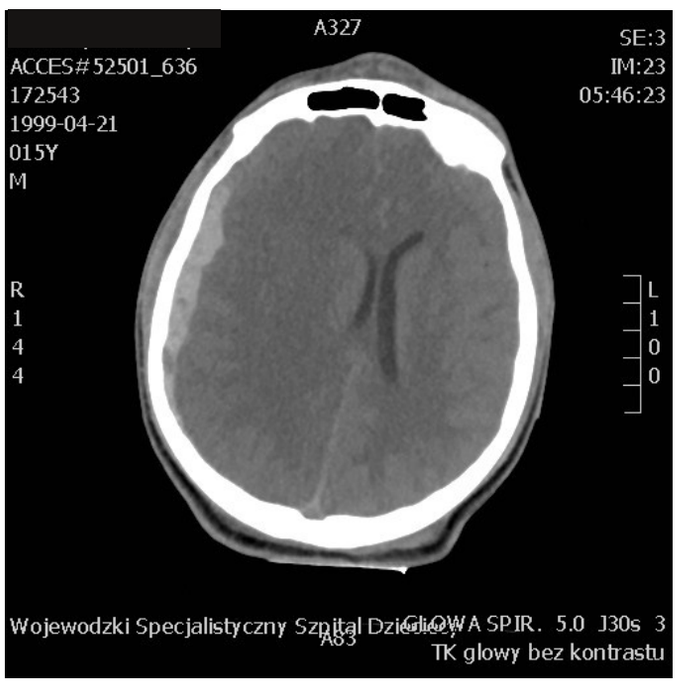

Fig. 1. 03.08.2014: The right lateral ventricle almost completely squeezed in, occipital part of the left lateral ventricle widened, otherwise the lumen of the left ventricle narrow

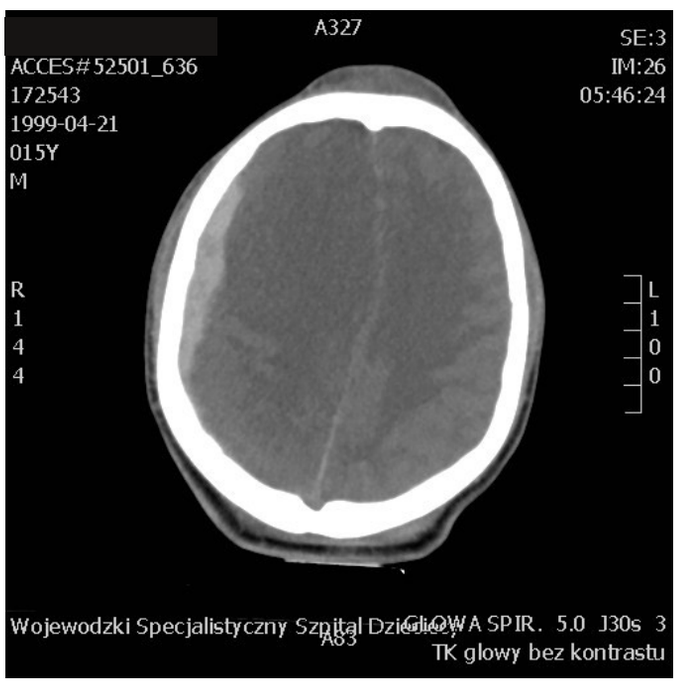

Fig. 2. 03.08.2014: In the right side of the temporal-occipital area there is a pericerebral hematoma up to 10 mm thick, causing the mass effect with the herniation under the cerebral falx, and the ventricular system shift to the left by some 10 mm

During the hospitalization, general and local therapies had been applied. The following antibiotics had been prescribed: Ceftriaxone, Meropenem, Fluconazole, Trimethoprim. The patient had been under intensive care, with the regular changes of the lying position. The CNS view (Fig. 3, 4).

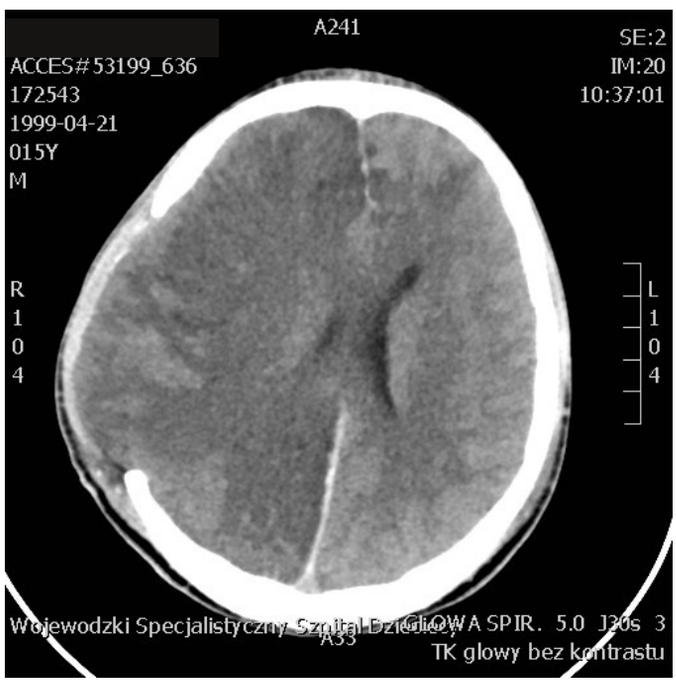

Fig. 3. 14.08.2014: Condition after the right side craniotomy, lack of the bone flap, size ca 10x7.5 cm, in the right occipital/temporal/frontal area. Mass effect with with the herniation under the cerebral falx, and the ventricular system shift to the left by 8 mm, with the protuberance on the perimeter beyond the skull outline

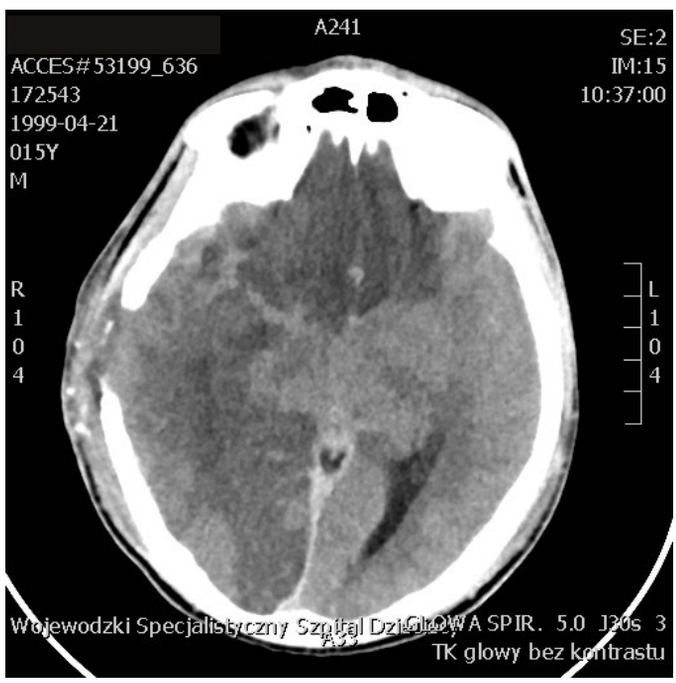

Fig. 4. 14.08.2014: Diffuse, inhomogeneous brain hemisphere hypodensity, larger on the right side, exacerbated in the lower parts of the frontal and temporal lobes, corpus callosum knee – diffuse changes, dropsical-ischemic with small areas of the hemorrhagic imbibition after the contusion

During the physiotherapy treatment, particular activities had been modified depending on the patient's clinical and functional condition. Because of the boy's serious general health condition – lack of the cardiopulmonary stabilization and the significantly raised body temperature – the decision to introduce a rehabilitation program had been made in the third week into the treatment. The daily therapeutic program consisted of four sessions, 20-30 minutes long, which began with the polysensory stimulation of the senses of taste, sight, hearing, and the stimulation of the cutaneous thermoreceptors. After the initial stimulation of the nervous system, the therapeutic activities had been directed to the areas of the head and the neck – primarily through the zones' stimulation, according to the Castillo-Morales method. Lowering of the hypertension and improving the pathological movement patterns,

helping the motor activities – had been made possible by means of the inhibition techniques, according to the NDT-Bobath concept. Dissociation, compression, traction and rotation techniques had also been used. At a later stage, the facilitation elements had been applied as well. PNF girdle and limb patterns, in accordance with the particular technique methodology, had been implemented and they allowed to retain the physiological range of motion. PNF patterns tightened up the main nervous system elements, stimulating the nerves' own tactile receptors. During the first stage of hospitalization, the antagonist-contract techniques had been applied to create the proper movement patterns; in the follow up stages, the same techniques were intended to improve the intermuscular coordination. The organism, prepared in such a way, even with the severe central coordination disorders, responded positively to the therapy, which applied the general movement patterns. The first and the second phase of rolling, crawling and the third position of the Vojta method – were employed. The purpose for those activities had been to get the reflex response from the long muscle chains, local stabilization, phase limbs activity and strong stimulation of the brain plasticity. Each therapeutic session had finished with a vibration within the chest area, while using the different pressures to preserve the possibly best respiratory performance, and methodological positioning of the patient to prevent the potential problems arising from his lying down position, maintained for a long period of time, and from the interoreceptory stimulation. The good functional results achieved had been strengthened with the KT techniques.

20.08.2014:
the therapeutic program had started. During the functional evaluation, there were observed: severe central coordination disorders, reflexes: optical-facial ROF – and acoustic-facial RAF (right side -, left side +/-), Babinski reflex right and left side +. There was no reaction to scent. No activity within the limbs. No swallowing reflex. No contractures had been found.
During the first 5 days of treatment, because of the unstable circulatory parameters (blood pressure from 110/70 to 140/100) the relatively gentle afferent stimulation had been applied, that is elements of the PNF method – shoulder and pelvic girdle patterns, elements of the Castillo-Morales method – areas of the face stimulation, elements of the Sensory Integration Therapy; atrial, as well as proprioception and touch, sight, taste, smell and hearing stimulation, respiratory therapy – pressure changes. During the above treatment procedures, the parameters did not worsen.

21.08.2014:
an improvement of the patient's general condition had been noted, initially it amounted to the optical-facial and the acoustic-facial reflexes being present in both, the right and the left side.

22.08.2014:
the Babinski reflex had disappeared.

26.08.2014:
with the stabilization of the cardiopulmonary parameters (blood pressure 130/80), physiotherapy procedures had been intensified, bringing in the general movement patterns and the Vojta method. During the first session, the patient responded in a positive way – with the active movements of the distal parts of limbs, and in the following session – also with the activity within the shoulder and pelvic girdles, and with the eyeballs movements. The therapy sessions lasted from 15 to 30 minutes, and were being repeated 3-4 times a day. The patient's condition to be seen on (Fig. 5, 6, 7).

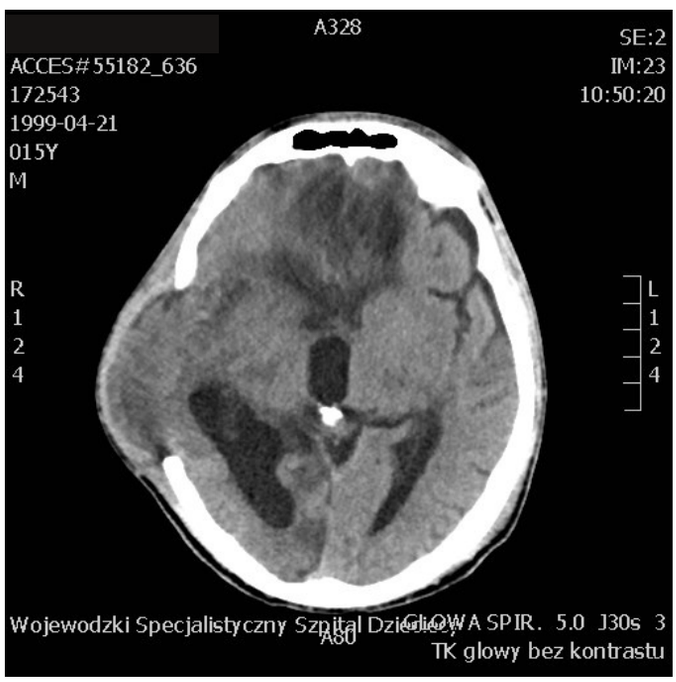

Fig. 5. 24.08.2014: Diffuse hypodensity areas – dropsical-ischemic at the basis of the frontal lobes on both sides, in the right brain hemisphere lobes and, locally, in the rear end of the left frontal lobe and on the border of the left temporal and occipital lobes. Ventricular system not shifted in regard to the midline, widened, with the asymmetric lateral ventricles – frontal corners depth: on the right side up to 21 mm, on the left to 18 mm, parietal corners width: right up to 14 mm, left to 6 mm, ventricle body width: on the right up to 22, on the left to 12 mm.

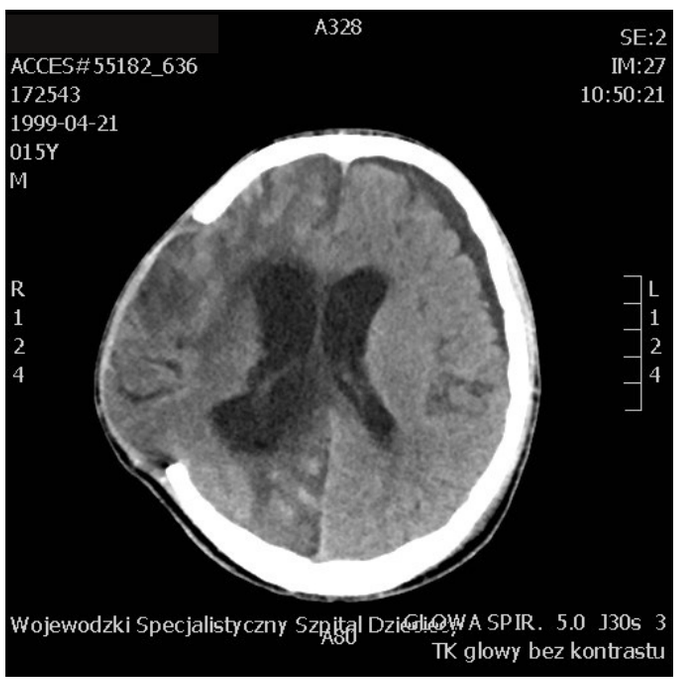

Fig. 6. 24.08.2014: Condition after the right side craniotomy – large part of the bone removed on the right side, in the temporal-occipital-frontal area, ca 97 x 80 mm, with brain herniation in this location. Diffuse hypodensity areas – dropsical-ischemic

Fig. 7. Condition after the right side craniotomy

30.08.2014:
the treatment had been suspended for two days, because of the neurological surgery of the ventriculoperitoneal shunt implantation, with the purpose to lower the intracranial pressure.

01.09.2014:
first active movements had been observed in the upper limb area, and there was a non-verbal response to simple commands.

04.09.2014:
first symptoms of the muscle tension increase in the distal parts of limbs, on the left side, had occurred. The most significant were: the clonic spasm in the ankle area, 5-10 degrees flexion contracture in the proximal and distal interphalangeal joints. Verticalization process had begun, up to the angle of 30-45 degrees, with no orthostatic disturbances.

08.09.2014:
elements of the manual therapy had been applied, especially in the area of the aponeurosis, to constrain the adverse symptoms of the pathological movement patterns. Patient's verticalization in progress, to the sitting position with legs down, preserving the following parameters: before the verticalization: blood pressure 120/75, heart rate 102; during the verticalization: 120/78, heart rate 105; after the procedure: 120/75, heart rate 106 (Fig.8).

Fig. 8. Verticalization to the sitting position

09.09.2014:
eye hand coordination and precise hand grip occurred.

19.09.2014:
body midline crossing with the right hand and, initially very brief (no longer than 1 minute) head stabilization in the all-fours position had been observed (Fig. 9)

22.09.2014:
verticalization to the standing position had been achieved, with no orthostatic disruptions, the patient attempted briefly to support the body weight on his right leg.

29.09.2014:
active raising of the right leg with the left knee joint stabilized.

01.10.2014:
unassisted control and head stabilization in the sitting position on a wheelchair. Ability to read a single word (Fig. 10).

Fig. 9. All-fours position

Fig. 10. Unassisted sitting position on a wheelchair

Fig. 11. Patient's condition on 27.10.1014

06.10.2014:
improved functionality of the upper limbs – the patient manipulated objects with his both hands. Patient spoke using simple sentences. First attempts to take drinks – the swallowing reflex present.

09.10.2014:
another neurological surgery – closing of the skull bones. Immediately after the surgery deterioration of the patient's motor performance had been observed, and dysfunction of the lower branch of the facial nerve, on the left side, became visible.

16.10.2014:
for the first time since the injury, the planned activity of the left hand occurred – the forearm had been raised by some 20 degrees and placed on the abdomen. The patient, only with difficulty, remained in the sitting position. He answered questions with single, simple words.

20.10.2014:
the patient initiated verbal communication. He spoke using complex sentences, narrated. Short-term memory dysfunction had been observed. The long-term memory – in order. Patient used speech articulation. Attempt to keep up the standing position with the left leg stabilized in orthosis.

22.10.2014:
active phase movement of the right leg with the left leg stabilized. First attempts to walk, with the therapist's aid and with the orthopedic equipment.

27.10.2014:
functional status as follows: supported by another person, the boy could walk a distance of up to 35 meters, he moved by himself within the bed area, with no difficulty could sit and consumed meals by himself, maintained efficient verbal communication. Visible: full range of active movements of the right side limbs, with the muscle strength of 4 points according to the Lovett's scale. Muscles strength in the left side limbs 3 – in the flexor group, 4 – the extensors, passive ranges of motion preserved, active within the 30-40% of the standard joint range of motion (Fig. 11).

After 85 days of hospitalization, the patient had been transferred to another medical unit.

Discussion

In the field of rehabilitation, for many years prevailed the opinion that the only tool in hands of a physiotherapist, while dealing with a non-responsive patient, had been the passive

exercises. Mainly to prevent the occurrence of mobility limitations and the bedsores. Massage and electrical stimulations had also been used – to avoid the atrophy of muscles. G. Doman and T. Fay, together with their team, had been treating patients after traumatic brain injuries for many years. They had been using the above described procedures and come to the conclusion, that their effectiveness had proven not sufficient. On the basis of research by Klosovski and Krech, it had become apparent, that the therapy should focus on the particular brain damage, which causes the dysfunctions, and not only on the body – where the symptoms occur. The present day physiotherapy for patients with the traumatic brain injury sees, as its major task, the simultaneous impact on all levels, which means stimulating the brain tissue plasticity and decreasing the neurologic deficit, and restoration of the cognitive-emotional functions – which is directly related to the improvement of the patient's quality of life [11, 13, 14].

Rehabilitation of a patient, comatose after the traumatic brain injury, should depend on the level of injury, the current stage of a patient, and on his/her functional problems – to reduce the effects of the central nervous system disorders. The physiotherapeutic rehabilitation program needs to be custom tailored to the individual motor skills of a patient. It would depend on the level of consciousness, the forced position resulting from the respiratory equipment connection, and the multiple organ injuries [7, 15, 16].

Special care must be taken when working with a patient, often in the unstable cardiopulmonary condition, as we have been noticing the growing number of iatrogenic complications in patients after surgery procedures. The wide range of the potential complications encompasses not only the adverse effects of the therapy – during the patient's hospitalization, but also the negative aftermath effects, including the disorders psychological in nature. Although the iatrogenic complications amount to just below 5% of all the complications, but they are possible – a good reason to be most careful in choosing the stimuli for the patient [17].

The very first physiotherapeutic procedures applied to a patient, after the severe neurological injury, are usually those related to the cardiopulmonary prophylaxis. Simultaneously, there should be applied stimulation of the general movement patterns, with the basic goal of providing the patient with maximum quantity of the proper afferent stimuli, which would help to prevent the joint deformities, regulate the muscle tension and stimulate the basic vital functions [13].

S. Levitt has proposed, common in many therapeutic models, detailed procedures for the rehabilitation of patients after brain injuries: developmental therapy, improper muscle tension prevention, execution and improvement of the movement patterns, application of the afferent stimulation, use

of the active movement, priming, preventing the development of distortions [18].

Based on the above described model, majority of the Polish medical units dealing with patients suffering from consciousness disorders – employ the relatively modern neurophysiological methods. Most often mentioned in the medical literature are the following: PNF method, Vojta method, NDT Bobath. Also being applied, is the speech therapy method, drawn on the Castillo Morales therapy – which is based on the stimulation of muscles participating in speech, that is facial and mouth muscles, pulmonary and chest muscles, and muscles controlling the head position. Together with the above listed methods, kinesiotherapy and physiotherapy exercises are being applied [6, 12, 19]. The authors of this paper propose the following model for rehabilitation of patients after the severe craniocerebral injuries, in which the patient's safety remains the key issue: (Fig. 12).

The comprehensive evaluation of rehabilitation methods, based on the research by Michalak and Solski, has shown that the information data published on the subject are insufficient. The published reports are mostly case descriptions, based on the small groups o patients [20].

With practically no standards defining the therapeutic treatment in patients after severe neurological injuries, there are questions being raised as to how quickly the rehabilitation treatment should begin, what should be its scope and for how long it should go on. According to Hoffman and von Wild, the rehabilitation process constitutes an integral part of the intensive care, after the initial evaluation of the patient's clinical condition and his/her needs. Thus the rehabilitation should begin as quickly as possible, after the patient's clinical condition had been stabilized. Rehabilitation, its methods, intensity, types of the treatments applied, the doses – are always custom tailored to the individual patient needs [9,21,22]. A valuable element, one that tops up the recovery process in patients after the traumatic brain injuries, is the cognition rehabilitation. Modern techniques, based on the brain-computer interface, create the new, greater possibilities for rehabilitation in this group of patients. Up to date research confirms the usefulness of a brain-computer interface for the patients with all types of consciousness disorders, except those with the locked-in syndrome. Undeniably, the brain-computer interfaces are among the most advanced solutions, able to support the therapy and to improve the quality of life of patients with the most severe deficits. Their large-scale implementation however, should be preceded by solid clinical research [23].

Based on our own observations over a period of some 20 years, we have developed the major guidelines for treatment of patients with the traumatic brain injuries: complications prevention – namely contractures and decubitus ulcers, intensive waking up procedures, respiratory system function treatment, verticalization with the physiologically stabilized

Suggested physiotherapeutic treatment for patients after traumatic brain injuries

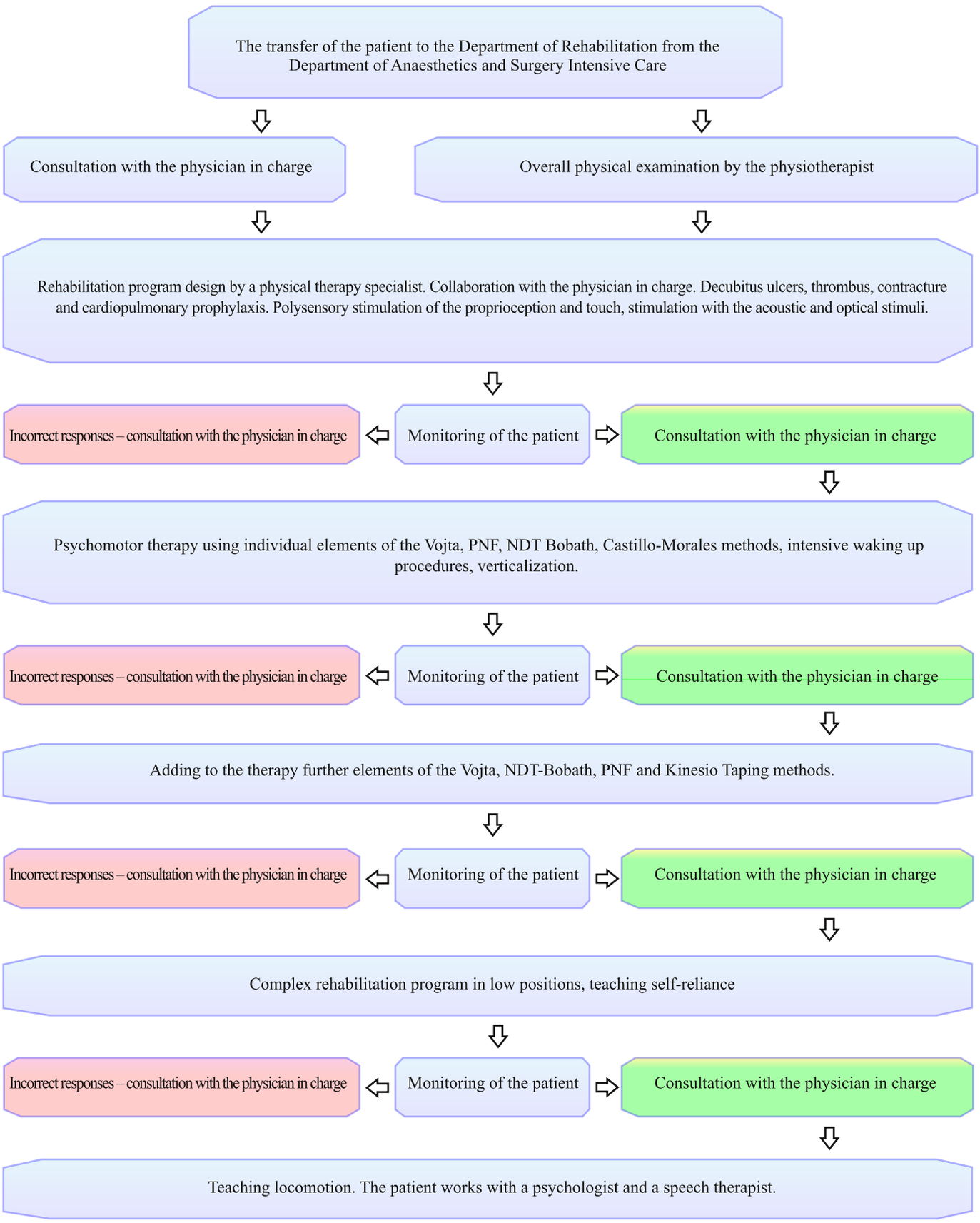

Fig. 12. Physiotherapy treatment scheme

"K" angle, sensory stimulation, swallowing and speech stimulation, activation of the general movement patterns with the preemptive eyes [25] and the proximal muscles activity. The authors also employ the above presented therapeutic program scheme – with a considerable success – in the infant patients treatment.

The applied physiotherapeutic methods had activated the extracellular proteolysis in the central nervous system (CNS), thus having a significant impact on the brain plasticity processes. For the therapy, such methods were chosen, which had afferent stimulated the CNS with the stimuli coming from all the possible peripheral receptors, both the somatic tissue and the bowels. Stimulated were exteroreceptors, proprioreceptors, but also tactile receptors of the sympathetic trunks and interoreceptors of the internal organs [26]. Continuous stimulation of the exteroreceptors had been provided by the KT application [27]. By way of such adjusted accumulation of the CNS afferent stimuli, the proteolysis mechanism had been fully stimulated via the serine protease and the matrix metalloproteinase. According to the newest research, these conditions lay the basis for the better CNS neuroplasticity [28]. Scale of the extracellular matrix proteolysis processes depends on the the level to which the nerve cells have been stimulated.

And the activation level of the CNS cells is also related to the time period between the injury and the time when the polysensory stimulation began, and to the length of the treatment – up to the point where the set therapy goals are met. During the presented treatment, there had been a very important factor – the continuous diagnostic monitoring, which dictated the current tasks and therapeutic goals. The continuous diagnostics also allow to maximize the effects while minimizing the necessary resources.

Conclusions

1. The most important issue in the physiotherapy treatment in patients after the traumatic brain injury – is the interdisciplinary rehabilitation based on the polysensory stimulation and on the general movement patterns, which combines the techniques of different methods.
2. Planning of the physiotherapy program in patients after the traumatic brain injury should be founded on the basic principles of the continuity, comprehensiveness and regularity, but most of all – on the early start of the rehabilitation process.
3. The competent physiotherapy treatment plays an important role in the restoration of the cognitive-emotional functions and in achievement of the maximum level of the psychomotor performance.

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