PHYSICAL REHABILITATION PROCEDURES AND HOLISTIC APPROACHES TO THE TREATMENT OF SOME NEURODEGENERATIVE DISEASES

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ABSTRACT

Neurodegenerative disease is an umbrella term for a wide range of disorders with one common aspect – they are all characterised by a progressive loss of neurons in the brain (cerebrum) and the spinal cord, as a result of which memory and motor skills. The most common neurodegenerative diseases include Parkinson’s, Alzheimer’s, Lou Gehrig’s and Huntington’s disease, multiple sclerosis and cerebral palsy; all these diseases require physical rehabilitation procedures. The holistic approach and the long-term aims of physiotherapy in these conditions focus on the good management of the process of recovery, maintenance and slowing down of the disease for the purpose of attaining optimal health and optimal recovery of the individual quality of life of the patient. The complex care for the patient calls for a syncretic-integrative approached combined with complementary therapy: self-therapy, physical rehabilitation and psychotherapy.

KEYWORDS: neurodegenerative diseases, holistic approach.

INTRODUCTION

The general strategies for managing neurodegenerative diseases include systematic medicamentous treatment, regular courses of physiotherapy, hygienic-dietary measures, a balanced diet, and an active exercise routine for the purpose of optimizing the way of life. Regardless of the fact that in recent years there has been a marked progress in the treatment
of these diseases, many patients, a few years after the onset of the disease, show various degrees of disability.\cite{1} Physical rehabilitation is mainly aimed at curbing secondary deficiencies, including disablement, coping with the psycho-motor deficit at a somatic and mental level. In their essence, physical therapy procedures include a complex of measures: medical, ergotherapeutic, psychotherapeutic, socio-psychological, social and educational. These objectives can be achieved by developing an individual physical therapy and rehabilitation program for each patient, corresponding to the severity of their condition, the occurring secondary deficiencies and potential for compensation, the psychological and social status of the patient and the possible support by the family environment.\cite{2}

The therapy of neurodegenerative diseases follows the multi-factor etiopathogenesis of the pathology. The comprehensive care for the patient calls for a syncratic-integrative approach and an appropriate accompanying/complementary treatment: somatotherapy, psychotherapy, and physical therapy. The somatotherapy is mostly medicamentous and is the core of the treatment. The physical therapy involves a range of auxiliary procedures, constituting functional therapy based on an accurate functional assessment.\cite{3}

**DISCUSSION**

Alzheimer’s disease is a progressive polypathogenic neurodegenerative disease, in which a combination of various mechanisms and risk factors cause anatomical/physiological, cellular and molecular changes leading to a disorder of the higher cortical functions, memory deficit, inadequacies in learning, behaviour and functions, as well as a total breakdown of the intellect and mental activity. The disease is mainly connected with the presence of senile or amiloid plaques and neurofibrile degenerations, connected with damaged cholinergic mediation, loss of neurons and damage to dendrites, axonal endings and synapsis. Microglial cells activated by the amyloids release pro-inflammatory cytokines and free radicals which cause mitochondrial dysfunction, release of L-Glutamate and neuron death.\cite{4}

Alzheimer’s disease has two forms: classical (presenile dementia), with an early onset – prior to 65 years of age, determined by genetic mechanisms, and senile dementia – with a late onset, after 65 years of age. 36 million people are affected and there is a trend for the incidence of the disease to increase fourfold in the next 50 years, with the incidence in women being 1.2-1.5 times higher than that in men. The risk for patients aged 65+ is 12-19% for women and 6-10% for men, and increases to 47% for both sexes after the age of 80.\cite{5}
The heterogeneous manifestation of the disease was first described in 1907 by Alois Alzheimer. The grey matter areas in the cerebral cortex which are affected include: 1) the hippocampus: controlling the semantic memory (for recent events); 2) the temporal lobe: responsible for memory, speech and hearing; 3) the parietal lobe: associated with speech, sense of touch, pain, space and temperature; 4) the frontal lobe: important for movement, speech, cause and effect relationships and identity; 5) the amygdala: controlling emotional reactions.[6] The dementia syndrome of Alzheimer’s disease is characterized by symptoms, such as cognitive, functional and behavioral changes: 1) amnesia stage – expressed in disturbances in rationalizing new information, slight anamia (name retrieval failure), disturbed visual-spatial abilities and executive functions (the ability to think in an abstract way and to switch from one type of mental activity to another), anxiety, irritability, spells of depression; 2) dementia stage – characterized by defects in understanding speech, echolalia (repeating what other people say) and palilalia (repetition of one’s own phrases and words) compounded by an expressed aphasia-apraxia-agonosia syndrome: a) aphasia - loss of the ability to pronounce words, with preserved speech apparatus and intellect; b) apraxia – loss of the ability to do pre-programmed motor tasks; c) agnosia – inability to recognize familiar people and objects; 3) terminal stage – emotional instability, reduced motivation, loss of semantic memory and of episodic memory (of their own experiences), immobilisation, muscular rigidity, retention of urine, infections, which are the most common cause of death. β-amyloid slowly increases in the course of the disease, depending on the duration and severity of the condition.[7]

Old age is the main risk factor for Alzheimer’s disease. Also proven risk factors are: genetic predisposition, history of Alzheimer’s disease and Daun syndrome in the family, Parkinson’s disease, oxidative stress, depression, epilepsy, migraine, hypothyreoidism[4], brain trauma, brain inflammation[8], disturbances in the blood-brain barrier, high diastolic pressure[9], hypercholesterolemia, atherosclerosis[10], arterial fibrilation, diabetes type 2, tumor processes, female sex, pregnancy at an older age, obesity, increased levels of Fe³⁺ in the body and of Al³⁺ in the drinking water, decreased levels of glutathione, alcohol abuse and compulsive smoking.[4,10]

The therapeutic approaches to patients with Alzheimer’s disease are connected with alleviating the symptoms to a different extent and for different periods depending on the form, stage and progression of the disease. The neuron degeneration is slowed down through: early diagnostics and early start of the treatment, long-term administration of the therapy, combining cholinergic, antiamyloid, antineurofibrilar, anti-inflammatory medicines[11], anti-oxidants[12], neurotrophic, neuroprotective and vasoactive ones.[13]
Parkinson’s disease is the second most common neurodegenerative disease of the central nervous system, after Alzheimer’s disease [Tanner C, 1996].

It is a progressive disease characterized by the slowing down of voluntary movements (bradykinesia) and increased muscle tone (rigidity), as well as numerous psycho-neurological manifestations. The average age at which the first complaints appear is around 55 years of age for both sexes. It is assumed that the incidence of Parkinson’s disease is approximately 160/100 000 and the annual one – 20/100 000. People from the white race stand a greater risk of developing the disease. The risk of developing the disease increases with age. The pathogenesis of Parkinson’s disease is connected with several biochemical anomalies: oxidative stress with subsequent destruction of the cells of substantia nigra, mitochondrial dysfunction, reduced energy level of the neuron and cell death. Another possibility is the toxic effect of substances product of the dopamine metabolism – for example, excytotoxicity of the glutamate, as well as some autoimmune processes leading to inflammatory changes and maintaining the damage to substantia nigra.[14]

Multiple (disseminated) sclerosis is another neurodegenerative disease with a huge medical and social significance. It affects 2.1 million people[15], with the number of affected women being twice as high as that of men. The etiological factors are: genetic predisposition, viral diseases, factors of the environment. The main forms of the disease are: relapsing-remitting, affecting 85% of the patients; secondary progressive; primary progressive (10%); progressive-relapsing (5%).[16] In this chronic autoimmune inflammatory neurological disease[17], the axons are demyelinated to a different extent. Multiple sclerosis is characterized by motor, vision, speech and memory disruptions.[18] In the demyelinated axons, as a result of the increased influx of potassium ions along voltage-dependent potassium channels located in the axonal membrane, there is a fast repolarization, and the transmission of the nerve impulse is obstructed.[19] The symptoms are verified by means of a laboratory complex: MRI, vision and hearing evoked potentials, C.S.F. test in which a typical oligoclonal type of gamma-globulins is obtained, when C.S.F. electrophoresis is performed.[14]

It has been established that in the human organism there is a dynamic balance between the formation of free radicals and the function of the defense antioxidant systems (superoxide dismutase, catalase, glutathione peroxidase, glutathione reductase, glucose-6-phosphate dehydrogenase).
Oxidative stress is the basis of pathogenesis of ageing and a series of diseases: Alzheimer, Parkinson, Huntington, amyotrophic lateral sclerosis (Lou Gehrig disease), Daun syndrome\cite{20}, autism\cite{21}, schiziphrenia, atherosclerosis, vascular diseases, chronic renal insufficiency, diabetes types 1 and 2, cancer\cite{20}, macular degeneration\cite{22}, psoriatic arthritis. The brain is particularly sensitive to the influence of free radicals due to the high consumption of oxygen. In Alzheimer’s disease, oxidative stress results from the disrupted balance between the endogeneous and exogeneous excessive production of reactive free radicals and the weakening of the anti-oxidant defense mechanisms.

Oxidative disorders are some of the first initial changes in Alzheimer’s disease and they occur selectively in the areas of the brain responsible for the control of the memory functions.

Oxidative stress plays an important role in the pathogenesis of neuron degeneration, because the production of free radicals presupposes the occurrence of inflammatory processes and the activation of programmed death of the nerve cells.

In Alzheimer’s disease, the recovery of the cholinergic deficit is achieved by means of compensatory therapy. In this direction, research continues for the purpose of improving the cognitive functions of new compounds: acetylcholinesterase inhibitors which possess additional action mechanisms and lower toxicity than the applied acetylcholinesterase inhibitors. Latest research is focused on suppressing or modulating of $\gamma$-secretase for the purpose of preventing the accumulation of amyloid plaque.

One of the approaches to the treatment of Alzheimer’s disease is the combination Galantaminehydrobromide/Pymadine (4-aminopyridine), due to the potential synergism of the pharmacological effect of the two components: the acetylcholinesterase inhibitor Galantamine and Pymadine, which enhances the release of acetylcholine.

It is necessary to use the health effects of Omega unsaturated fatty acids to optimize the diet of different social groups. The importance of aminoacids for the vital functions of the human organism is unquestionable, and so is the need for analytical control of their indicators. Many vegetable and plant products containing biologically active substances are of great significance for the prophylaxis and maintaining therapy of a series of diseases, including diseases connected with neurodegenerative changes, such as Alzheimer’s.
As with most chronic diseases, patients turn to holistic and alternative medicine, which is not backed up by clinical research and scientific arguments, for example Swank diet, herbal therapy (including the use of medical cannabis), hyperbaric oxygenation and self-infected ancylostoma (also known as helminthic therapy).

Physical rehabilitation treatment programs are structured on the basis of the principle of the physical rehabilitation puzzle, synergistically combining various natural and preformed factors.

In neurodegenerative diseases, complex physiotherapy is a mandatory component of the whole therapy and thus it slows down the progression of the disease and improves the quality of life and longevity. When applying medical physical rehabilitation, it is deemed best to combine appropriate medicines with certain physical factors, depending on the main clinical syndromes, specifics of the immune status, type and character of the course of the disease. It is aimed at prophylaxis, overcoming or compensating for the damage using various means of active and passive kinesitherapy. In cases of multiple sclerosis, kinesitherapy has to be purposeful, tailored in accordance with the main symptoms and should not lead to fatigue of the patient. Procedures which increase the body temperature are not acceptable, because even the slightest temperature increase leads to demyelinization and disruption of the transmitted nerve impulses. Remedial/medicinal gymnastics is with an emphasis on analytical gymnastics, isometric, isotonic exercise, mechanotherapy.

In the physical rehabilitation therapy, stretching exercises play a vital role in maintaining the scope of movement and in the fight against spasticity. In the case of severe spasticity, stretching should be careful and slow so as not to cause a stretch reflex. Breathing exercises between stretching ones prevent the development of stagnancy processes in the lungs and reduce the feeling of fatigue. Facilitating exercises and the inclusion of ergotherapeutic activities, such as training in cope independently with everyday activities, play an important role in the physical rehabilitation therapy. Physical exercise is of vital importance to patients with Alzheimer's, Parkinson diseases and multiple sclerosis, as they contribute to preserving their ability to work, to cater for their own personal needs, and also prevent the motor functions from deteriorating.

Remedial/medicinal/ massage also has a beneficial effect. The massage is recommended to be gentle and relaxing. It should not cause a stretch effect or result in an increase in the
patient’s temperature. The massage also has a physiological effect on the activity of the nerves and muscles of patients.

Of the preformed physical factors, the following play major role in physical rehabilitation therapy: low-frequency impulse magnetic field, deep oscillation, ultrasound applied paravertebrally, galvanic collar in Shcherbak’s method, electrophoresis with nivalin and electrostimulation.[30]

Underwater gymnastics curbs the manifestations of functional neurological disorders. It should be done in water of moderate temperature, since procedures accompanied by thermal influences lead to a deterioration of the neurological status.

Cryoherapy is yet another therapeutic method. It is based on the effect of low temperatures for the cooling of tissues, organs and the whole body. Different sources of cold are applied, with a wide range of temperatures – from 0° to -180°C. Aerocryotherapy is one of the most efficient methods of non-medicamentous treatment of spasticity and the pain syndrome in neuroregenerative diseases.

On a global scale, many patients turn to alternative methods of treatment. The low-fat diet is very popular; it is based on the fact that in populations with low consumption of animal fat (Asians) the incidence of multiple sclerosis is quite low.[31] The menu should contain carrots, beetroot, cabbage, cauliflower, parsley, grapefruit and other fruit rich in trace elements. A diet similar to that for diabetics is recommended, provided carbohydrates are excluded and animal fat is replaced by vegetable fat.

Hyperbaric oxygen therapy is another alternative method. It is conducted in a multi-seat baric chamber full of air, in which patients breathe in 100% oxygen at a pressure of 1 atmosphere, using oxygen masks or hoods. The therapeutic scheme is determined depending on the condition of each patient. Thus the stay in the baric chamber varies from 45 to 90 minutes. Hyperbaric oxygen therapy improves metabolism and cell breathing, and neutralizes the free radicals.

Research shows a drop in the frequency of bouts of the disease in patients with multiple sclerosis taking cannabinoids.[31] A small quantity of the substance delta-9-tetrahydrocannabinol (THC), contained in the marijuana plant, may slow down or stop altogether the development of Alzheimer’s disease. THC is known as a strong anti-oxidant
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with neuroprotective properties. It directly affects Alzheimer’s disease facilitating the decrease of the levels of the beta-amyloid protein, preventing its build-up and facilitating the mitochondrial function, according to Chuanhai Cao.\textsuperscript{[32]}

Cognitive rehabilitation is another alternative therapeutical method, aimed at re-training the abilities to think, to reason, to evaluate, to make decisions and to plan activities. It is focused on recovering the deficits of memory, attention, learning skills, etc., in patients with neurodegenerative nervous diseases.

The aim of cognitive rehabilitation is to assist human abilities to process information and to improve the functioning of the patients in all spheres of social and family life. “Extended repetition” is a method aimed at retrieving certain parts of the lost information.

This method has been adapted to Alzheimer patients, and problems with memory, with an emphasis on training names of objects, people and places. With time, the application of this method may even lead to learning new information.

In its report for 2011, the World Alzheimer Association recommends daily mental exercises for people with mild to moderate form of dementia. These exercises result in short-term improvement and they also slow down the development of the condition. It is good if these activities and exercises stimulate both the mental and the social activity of the patient. They may be conducted in a group or individually, by specialists or members of the family. There is a wide range of such activities and exercises:

- mental: puzzles, word games, social games, reading;
- physical: walking, exercises for the legs and arms, dancing;
- social: communicating with family and friends;
- domestic chores: washing-up, folding the laundry, laying the table, feeding pets;
- creative: drawing, knitting, playing a musical instrument; everyday care.\textsuperscript{[33,34]}

Cognitive rehabilitation is part of the whole process of rehabilitation.

CONCLUSION

Physical therapy and rehabilitation are key components in maintaining the quality of life and physical activity of the patient, thus improving the prognosis for the development of the disease. The early identification, diagnosis and determining the type and form of the disease are of vital importance. The therapy should follow a strict sequence of rehabilitation...
algorithms and should be tailored to the individual specifics of each patient, applying a complex and comprehensive approach in the kinesitherapeutic programs.

As stated in the White Book on Physical and Rehabilitation Medicine in Europe, 2006, rehabilitation activities constitute a complex system of social, pedagogical, medical prophylactic, training and psychological procedures aimed at achieving the most complete, as far as possible, physical and mental recovery of the social independence and participation in social life.

In modern rehabilitation /physical rehabilitation/, the holistic approach to the patient is mandatory, based on the complex of: cognitive ability (orientation, attention, memory, ability to collaborate in implementing medicinal procedures); scope and volume of movement (active and passive); muscle strength (weakness), presence of a motor deficit; coordination; agility; stamina.

REFERENCES


