

## HYPERBARIC OXYGENATION IN COMPREHENSIVE TREATMENT OF PARKINSONISM

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Various physical factors have, in recent years, found ever wider application in the treatment of diseases of the nervous system. Hyperbaric oxygen is one of these. Hyperbaric oxygenation (HBO) permits elimination or reduction in the severity of hypoxia, and the improvement of general and regional blood flow and metabolic processes, and exerts a normalizing influence on the central nervous system and the adaptive mechanisms as well. The positive results of the use of HBO in a number of neurological illnesses have been illuminated in many publications [4, 6]. We have not found any information in the literature regarding the utilization of HBO in parkinsonism.

The prevalence, the severity of the course of the disease, and the early disablement of the patients determines the urgency of the problem of treating parkinsonism. Despite the extensive use of an armamentarium of pharmacological and physiotherapeutic means, as well as of neurosurgical methods, the treatment of parkinsonism still presents definite difficulties [1, 2]. The symptom complex, including tremulous hyperkinesia, bradykinesia, and muscle rigidity, which is characteristic of the disease, can develop with brain lesions of varied etiology. The structural disturbances of the subcortical formations of the brain which arise under the influence of pathological factors are accompanied by dysfunctions of neurotransmitter systems.

The purpose of the present investigation was an assessment of the effectiveness of the utilization of hyperbaric oxygen in parkinsonism, the selection of optimal treatment conditions, and the determination of the indications for the prescription of HBO.

We had under our observation 64 parkinsonian patients, 29 men and 35 women ranging in age from 37 to 78 years. (3 individuals from 37–39 years; 12 individuals from 40–49 years; 27 individuals from 50–59 years; and 22 individuals 60 and above). The duration of the illness ranged from 1 to 15 years, but up to 5 years in the majority of patients. The etiological factors included the following: atherosclerosis of the cerebral vessels in 49 patients; this combined with arterial hypertension in 6; a history of encephalitis in 8; closed craniocerebral trauma in 1. The rigid-tremulous form of the illness was observed in 37 patients; the akinetic-rigid form in 19; and the tremulous form in 8.

The HBO was carried out in single-seater "Oka-MT" treatment pressure chambers; pure oxygen served as the hyperbaric medium. The sessions were carried out with the individual selection for each patient of an isopressure regime within the limits of 1.3–2 ata, with an exposure of 40–60 min. The course of treatment included 8–12 procedures. The HBO was combined with the taking of nootropic medications and preparations improving the microcirculation. Prior to coming to the hospital, 37 patients had received anti-parkinsonian agents of various pharmacological groups continuously, with insignificant effect; the doses of the preparations and the daily schedule of their use did not change during the HBO treatment.

The indices of the systemic and brain hemodynamics were studied in 18 patients before and after a course of HBO of tetrapolar transthoracic rheography using the system of leads of W. Kubicek and co-authors [7], as well as of a noninvasive determination of the volume velocity of cerebral blood flow [5]. The state of the sympathoadrenal system and the changes in it under the influence of the treatment were assessed on the basis of the daily excretion of adrenaline and noradrenaline in the urine.

One or two sessions of HBO permitted the achievement of an improvement in general state of feeling in all patients, irrespective of the form and etiology of the illness. Perceptible shifts in neurological status were identified, as a rule, in the middle of the course of treatment (4th to 6th session), and in 1/3 of the patients, following the 2nd to 3rd session, an improvement in mood, the consolidation of the processes of thinking and memory, and a reduction in muscle tone to the extent of its normalization by the end of the course of treatment were observed. Facial expression became more lively, the motoric reper-

toire expanded, gait improved, and the accompanying vegetative disturbances were eliminated. The tremulous hyperkinesia leveled off at the same time; however, the degree of its regression was less in the majority of observations than the degree of regression of the akinetic-rigid syndrome.

The therapeutic effect was evaluated on the basis of clinical criteria; in the process the degree of restoration of the act of walking, and of the decrease in the degree of muscular rigidity, of tremulous hyperkinesia, brady- and oligokinesia, and masked facial expression, was taken into account. Good treatment results were noted in 18 patients. In three of these, remission of the disease was achieved. The therapeutic effect was considered satisfactory in 26 patients. Regression of the neurological disturbances was insignificant in 11 observations, while in 5 a positive time course was not observed; however, during the HBO session and for 1–3 h following it, a decrease in the frozen character and in the severity of the tremor were observed even in these patients. Four of the patients terminated treatment in connection with claustrophobia and the development of hypertensive crises.

The effectiveness of HBO was higher in vascular parkinsonism than in the encephalitic form. Significant regression of the akinetic-rigid syndrome was observed in patients with the use both of low (1.3–1.5 ata) and isopressure regimes at higher limits (1.8–2 ata), whereas therapeutic pressure of 1.8–2 ata was more effective in the case of tremulous hyperkinesia.

Analysis of the history of 36 patients showed that the therapeutic effect achieved by the use of HBO was maintained up to six months. The course of treatment was repeated at a frequency of two times per year in order to stabilize the patients' condition.

The eukinetic type of blood circulation in 10 patients, and the hyperkinetic type (with a moderate elevation in the indices of cardiac output and an insignificant decrease in peripheral vascular resistance) in 8 patients, were identified in the course of the investigation of the systemic hemodynamics. The volumetric indices of brain blood flow were not significantly changed, although rheoencephalographic signs of cerebrovascular atherosclerosis were detected, in the form of a reduction in the velocity indices of the ascending half-wave and rigidity of the vascular wall upon functional testing, as well as reduction in blood flow in the microcirculation zone. The systemic hemodynamics approached the eukinetic type following the course of HBO in the majority of patients. Shifts toward normalization of the velocity and amplitude indices of the REG were observed.

Investigation of the sympathicoadrenal system in 24 parkinsonism patients prior to treatment revealed diverse alterations in its activity on the basis of data of the daily excretion of catecholamines, both in the direction of decrease and increase, pointing to an imbalance in the system. The absence of a correlational dependence between the hormonal sympathetic components also confirmed its dysfunction. A trend was noted upon investigation of catecholamine excretion toward normalization of the sympathicoadrenal system following a course of treatment. At the same time a weak inverse correlational association was revealed between the excretion of adrenaline and noradrenaline.

We present the following clinical observation in illustration of the above.

Patient S. [female- Tr.], 49 years of age, a physician, entered the Neurological Department of the Moscow Oblast M. F. Vladimirskii Scientific Research Clinical Institute [MONIKI] on 10/10/86 with a complaint of weakness and a feeling of immobility in the right extremities, impairment in handwriting, difficulty in ambulation, and poor memory. She was suffering from hypertensive disease with elevated arterial blood pressure up to 160/100 mm Hg. She had been treated irregularly. She had observed the appearance of immobility and disturbance in handwriting and ambulation about a year ago. Hypomimia, retardation of movements, and lag in the movement of the right arm during ambulation were noted objectively. The cranial nerves were unremarkable. The plastic type of increased muscular tone was more pronounced in the right extremities. Tendon reflexes predominated on the right. The pattern of hypertensive angiopathy was noted in the optic fundus. Skull x-rays normal. Midline structures were unshifted by echoencephalographic data. On the EEG, indistinctly expressed diffuse changes were noted in the form of attenuation of  $\alpha$ -activity and a decrease in the general amplitude of the recordings. Systemic hemodynamics of the eukinetic type and volume velocity of cerebral blood flow were unchanged. Increase in tonus of medium and small caliber vessels, primarily in the occipital-mastoid leads, was noted on the REG. Daily urinary excretion of adrenaline was moderately increased (56.5 nmol/day), while the excretion of noradrenaline was decreased (65 nmol/day). HBO treatment was carried out using an isopressure regime of 1.2–1.5 ata; duration of sessions, 40–50 min. Ten procedures were performed. The patient received injections of xantinol nicotinate, aevit, and vitamin B<sub>6</sub> at the same time. She was also taking cavinton. Discharged 11/4/86. Muscle tone had normalized, handwriting and gait had recovered, and facial expression was more lively. The patient noted improvement in memory and capacity for work.

Six months later the feeling of immobility in the right extremities and the plastic type of increased muscle tone had reappeared. The patient remained in the Department from 5/6/86 through 5/22/87. A repeat course of HBO was carried out: nine forty-minute sessions of isopressure regimes at 1.25–1.65 ata. Pharmacotherapy was not prescribed. Normalization of muscle tone and gait was noted upon discharge. Discharged with a recommendation for a course of outpatient treatment with vasodilators and nootropic agents.

Thus, in a middle-aged [female] patient with class II B hypertensive disease and dyscirculatory encephalopathy, including parkinsonian phenomena, repeated courses of HBO promoted clinical improvement and work rehabilitation.

The data obtained indicate that HBO increases the effectiveness of the treatment of parkinsonism and can be utilized both in combination with antiparkinsonian agents and as an independent modality. The utilization of a treatment regime of 1.3–1.6 ata is most advisable for the rigid forms. When tremulous hyperkinesia predominates in the clinical picture isopressure regimes within the limits of 1.8–2 ata are more effective. Better results are achieved in patients up to 65 years of age, with the vascular forms of parkinsonism, with predominance in the clinical picture of the akinetic-rigid syndrome, and with a duration of the illness of 1–5 years, all of which should be taken into consideration in prescribing HBO.

Along with its direct antihypoxic and metabolic influence, the normalizing influence of hyperbaric oxygen on the state of the sympathoadrenal system, leading to improvement in general and regional blood flow, has definite significance in the realization of the remedial effect of HBO. The blood-brain barrier is impermeable to the biogenic amines [3]; therefore the state of the neurotransmitters systems of the brain cannot be judged on the basis of their daily urinary excretion. However, based on the favorable influence of HBO on the indices of the activity of the sympathoadrenal system, a positive influence of hyperbaric oxygen on the monoaminergic systems of the brain as well can be hypothesized.

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