Review of Treatment Methods and Outcomes in Patients with Ophthalmic Pathology at Piket Sanitarium, Kislovodsk

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Abstract: On the basis of multidisciplinary Piket Sanitarium, located in Kislovodsk at 1000 m above sea level, the Ophthalmology Division has been operating since 1958, where, for the first time in the world, treatment of glaucoma patients was carried out using natural healing procedures (balneotherapy, climatotherapy, health path). In recent years, in connection with a change in the structure of eye morbidity and disability due to vision impairment and blindness, the indications for sanitarium (medical health resort) treatment at the Ophthalmology Division of the Piket Sanitarium have changed and expanded. Currently, comprehensive therapeutic treatment is conducted here for patients with various diagnoses: retinal dystrophies, stages 1–3 of primary glaucoma, various forms of optic nerve atrophy, senile immature cataracts, non-proliferative form of diabetic retinopathy, opacities of the cornea and vitreous humor, and bullous keratopathies [1]. Rehabilitation is carried out for the patients with acute vascular circulatory disorders of the retina and optic nerve, after surgical interventions for glaucoma, extraction of mature cataracts, refractive keratotomies, laser refractive keratectomies, refractive errors (such as myopia, hyperopia, astigmatism and strabismus), and different types of amblyopia. These ailments are the consequences of general medical and social problems. For rehabilitation, along with the use of natural healing factors, the following procedures are employed: a) ultrasonic irradiation by phonophoresis or by acoustic contact *via* an isotonic sodium chloride solution or *via* an oil medium through the skin of eyelids [2]; b) electrical stimulation of the oculomotor and ciliary muscles, and optic nerve; c) alternating magnetic field of sinusoidal shape, 50-cycle, longitudinal mode; d) laser stimulation of the retina and optic nerve using helium-neon and diode lasers; e) quantum color stimulation, the use of optical simulators, darsonvalization of eyelid skin, Narzan mineral water irrigation of the eyelids and conjunctiva. The review presents ten-year results of treating patients at Ophthalmology Division using novel techniques of natural factors.

Keywords: glaucoma, optic nerve atrophy, cataract, retinopathy, refractive errors, balneotherapy, climatotherapy, health path, Narzan mineral water, ultrasonic irradiation, electrical stimulation, alternating magnetic field, laser stimulation, color stimulation.

Introduction

The main group of patients has been treated at Ophthalmology Division for primary glaucoma of different stages, degree of compensation, in different age groups, with concomitant pathology. Currently, glaucoma is defined as a pathological condition of the optic nerve with progressive death of the ganglion cell axons forming the optic nerve, leading to an impairment of the visual fields as a result of anterior ischemic optic neuropathy and an increase of intraocular pressure (IOP). The latter is the driving force of metabolic processes among the fluid, circulating in the eye, and avascular structures (cornea, lens, vitreous body), is involved in the regulation of blood flow through the intraocular blood vessels, and also maintains their permeability at a normal level [3].

Stage-dependent glaucoma treatment

There are multiple factors in the etiology of primary glaucoma: hemodynamic disorders, metabolic disorders, and neuroendocrine changes against the background of involution of the organism. In the situation with multiple existing etiologies of glaucoma, therapy was prescribed depending on the stage and degree of compensation, age, and concomitant pathology. Each patient was examined by a therapist and specialists, as needed. According to the stages of the disease, four groups of patients were identified and followed-up for ten years:

- With stage 1 – total of 6702 eyes (without narrowing of the visual field),
- With stage 2 – total of 6648 eyes (narrowing of the visual field by 10–15 degrees),
- With stage 3 – total of 5552 eyes (narrowing of the visual field up to 40 degrees),
- With stages 4 or 5 – 102 eyes (residual peripheral visual field – 21 degrees).

At all stages of glaucoma, therapy included:

1) Alternating magnetic field of sinusoidal shape, 50-cycle, 10–15 repetitions, exposure 3–15 minutes (depending on age);

2) Electrical stimulation of the ciliary body and ciliary muscle and optic nerves; 1–2 mA current, exposure 1–2 min, 10–15 repetitions;

3) Quantum color stimulation using Pankov's glasses with an exposure of 1-5 min, 10 repetitions;

4) Individual antihypertensive therapy *via* instillation of eye drops.

When narrowing the visual field was narrowed over 20 degrees from the nasal side, additional therapy included:

1) Laser stimulation of the retina and optic nerve using a laser helium-neon stimulator: base mode, 60–90 % energy capacity, 120 sec exposure; 10–15 repetitions;

2) Ultrasonic stimulation with an intensity of 0.4 W/cm^2, a frequency of 880 kHz, and exposure of 5 min; 10 repetitions using two techniques.

At stages 3, or 3–4, therapy was accompanied by intranasal instillation of 1% Semax® nootropic solution for two weeks. The therapy lasted up to 15–20 sessions per course.

Ophthalmologic therapy was carried out against the background of general sanitarium resort therapy: balneotherapy, climatotherapy; *terrain-cours,* or health path (the method of health resort treatment providing dosed physical activity in the form of walking, or climbing up mountainous terrain along certain marked routes), collar zone massage, and physical therapy [4].

In an earlier study of the hemodynamics in the brain and eyes, patients with glaucoma showed low hemodynamic parameters in the vertebrobasilar basin, but there was no initially pronounced pathology of the carotid basin. The latter appears with age and severity of the glaucoma process. Hemodynamics was impaired more noticeably in the tissues of the eye, improving in the course of therapy, along with the indicators of cerebral hemodynamics in both basins.

As a result of the complex therapy, an improvement in hemodynamics in the optic nerve, ciliary body, retina, and posterior ciliary arteries was recorded. These data were published in the earlier articles based on the results of hemodynamics study of the brain and eye of healthy subjects *versus* patients with eye pathology (glaucoma, macular degeneration, and diabetic retinopathy), conducted at Piket Sanitarium [2–7].

A significant decrease in IOP, normalization of outflow, which was expressed in an increase of visual acuity, expansion of visual fields, and an improvement in general health condition were revealed. The effectiveness of glaucoma treatment (depending on the stage) was as follows:

At stage 1 – 95 %,

At stage 2 – 90%,

At stage 3 – 42%,

At stages 3–4 – 6 % without a predictive guarantee for the duration of the stabilization effect. The presented data demonstrated high overall efficiency of glaucoma therapy at early stages, which implied the need for early diagnosis and systematic treatment [5].

During the subsequent year, the medical course is recommended, which includes vasoprotective medications, nootropics, antioxidants, vasodilators, drugs; vitamin therapy, individual antihypertensive regimens. Most patients repeat the therapy course over many years, keeping visual function in a stable state.

There is a group of patients, who are treated at Ophthalmology Division for 15–20 years, maintaining glaucoma stages 1 or 2. Patients with glaucoma stages 3–4 have the ability to maintain at least a peripheral visual field, which makes it possible for them to take care of themselves and move around a smaller space. Rehabilitation of this group of patients requires a specific approach and attention of an ophthalmologist, therapist, and psychotherapist.

Treating age-related macular degeneration of the dry type

The second large group of patients are those with macular degeneration. Over the past decades, the eye vascular system pathology, against the background of general vascular diseases, has become the leading cause of blindness and low vision acuity in the group of 50–70 years old patients, which is a significant ophthalmological and social problem. An increase in the proportion of dystrophic disorders of the retina and a progressive decrease in vision acuity, despite long-term medication therapy, make timely detection and the improvements in treatment methods of senile dystrophies of the macular region in the retina crucial. The latter, due to the peculiarity of hemocirculation and metabolism, is the most vulnerable part of the retina and its pigment layer, reacting early to hemodynamic disturbances [5].

Numerous studies proved the positive impact of the natural factors of Kislovodsk region on the general hemodynamics and microcirculation, metabolic processes, via increase in the overall oxygen balance [6]. We observed 1130 patients, who were treated in a Kislovodsk sanitarium for 18 days at a specialized Ophthalmology Division. The majority of patients (835) were 50–60 years old; the rest (265) were 60–75 years old. Clinical examination was conducted in accordance with a generally accepted technique. Ophthalmologic examination included visual acuity and visual field testing, direct ophthalmoscopy, slit-lamp (biomicroscopy) examination, color perception study, and a photostress test.

The patients were divided into three groups depending on a stage of macular degeneration (i.e., depending on the severity of macular changes and visual acuity changes):

- Group 1 (stage 1) – changes in the macula in the form of deformation, weakening, and disappearance of the foveolar reflex; visual acuity 0.9–0.7;

- Group 2 (stage 2) – changes in the form of dusty turbidity of the macular region, along with dystrophic yellowish foci with paramacular (and within the macula) accumulation of pigment, in combination with solid retinal drusen in the central part of the fundus; visual acuity is reduced down to 0.3; metamorphopsias, minor defects in visual fields, and changes in color perception (onto red and green);

- Group 3 (stage 3) – changes in coloration of the macula lutea area to dark red or yellow-brown; spread of dystrophic yellowish foci – hard and soft drusen outside the macular region, equal in diameter to 1–2 optic disc drusen (ODD); small hemorrhages in the fundus center; visual acuity below 0.2; all patients had central scotomas of various sizes, changes in color perception onto primary colors; it is noteworthy that the lesion of the left eye prevailed, or else, its more severe condition was detected in conditions of a bilateral process.

Complex spa therapy, catered to all patients, included natural healing factors (climatotherapeutic procedures, health path, carbonic Narzan baths) in combination with physical therapy procedures: variable magnetic for 20 minutes in the amount of 15–20 sessions; ultrasound on an open eye, exposure 5–10 minutes, 10–15 repetitions; laser stimulation H-60-90 %, exposure of 120 sec., 15–20 sessions; quantum color stimulation with Pankov's glasses exposure 5–10 min, 10 repetitions.

Massage of the collar zone, exercise therapy, and use of a special technique aimed at enhancing blood circulation in the muscles and membranes of the eye, were prescribed for all stages of macular degeneration.

Improvement of blood circulation in the brain and eyes promoted an increase in visual functions at all stages of the disease, which suggested a possible improvement in redox processes in the eye membranes, and increase in the hypothalamus effect on the ganglion cell layer and the pigment layer of the retina [7]. The left-sided asymmetry of earlier and more pronounced lesions of the eye membranes and the carotid basin made it possible to assume the presence of the carotid system pathology on the left in patients with senile nonexudative macular degeneration, which was confirmed by a low rheographic index at the onset of the ailment and its dynamics during the therapy.

All of the above factors had a positive effect on the visual functions of the eye at the end of the therapeutic treatment. Visual acuity was within 0.99 ± 0.01 at stage 1, 0.68 ± 0.025 at stage 2, 0.2 ± 0.02 at stage 3, with reduction of the area of central scotomas. After the end of treatment in the sanitarium resort conditions of Kislovodsk, an annual supporting medication-based vascular and dedystrophic therapies were recommended at the place of residence for 10 years.

In 49 % of the patients with stages 2 or 3, visual functions stabilized; in 45 %, they were unstable; 6 % of the patients exhibited a transition into wet macular degeneration [8]. Also, our data indicated the need for early diagnosis and treatment within stages 1–2 of the dry-type macular degeneration process, including, whenever possible, a sanitarium health resort therapy.

Treating simple (exudative) diabetic retinopathy

Treatment of diabetic retinopathy remains the most urgent problem of modern ophthalmology, a characteristic clinical and morphological manifestation of which is microangiopathy, i.e. a generalized lesion of all links of the microcirculation pathway. The latter, along with impaired microhemodynamics and changes in the rheological properties of blood, leads to a disorder of retinal metabolism.

On the basis of the Ophthalmology Division at Piket Sanitarium, 1052 patients with non-proliferative form of diabetic retinopathy were treated. Diabetes mellitus of mild and moderate severity was diagnosed, in the phase of compensation, types 1 and 2. The complex therapy, conducted for 21 days, included climatotherapy in the form of comfortable aerotherapy; *terrain-cours* along the health path B; balneotherapy (Narzan baths) at a temperature and duration, depending on the general condition of the patient, and condition of the retina and refractive media.

Along with the use of natural factors, the following physiotherapy was prescribed:

- Ultrasonic irradiation with acoustic contact *via* an isotonic sodium chloride solution with an intensity of 0.4 W/cm^2, a frequency of 880 kHz, an exposure of 5 minutes, in 10–15 repetitions; or through the eyelid with an alternating magnetic field of sinusoidal shape, 50-cycle, an exposure duration of up to 20 minutes, 10–15 procedures;

- Laser stimulation of the retina (helium-neon scanning laser) with an energy exposure of J/cm^2, time exposure of 120 sec, 10–15 procedures per course;

- Narzan irrigation of eyelids and mucous membranes were carried out for 3 minutes, 10 procedures per course;

- Quantum color stimulation for 1–5 minutes, 10 repetitions.

The above complex treatment was conducted against the background of heparin therapy (5000–10 000 units of heparin subcutaneously, No. 10) and administering Retinalamin (short peptides) as 10 parabulbar injections.

As a result of the therapy, all observed patients displayed positive dynamics of their blood rheological properties and microhemodynamics, leading to the resorption of exudates and retinal hemorrhages, while improving visual functions (by 0.2–0.5 according to the Sivtsev tables) [9].

The recommended 12-month treatment regimen at the place of residence includes:

1. Tricor (Fenofibrate) – 145 mg, once a day for 6 months;

2. Wobenzym – 3 pills × 3 times a day for 2 months (to be repeated three times a year);

3. Solcoseryl (Actovegin) – 5.0 ml intramuscularly or intravenously, 10–15 injections twice a year;

4. Retinalamin – 1 vial (2 ml) of intramuscular injection, No. 10 (to be diluted with 2 ml of 0.5 % novocaine water solution for injections); to be repeated after 3–4 months or after 6 months;

5. Ginkgo-Smart (Ginkgo biloba) – 1 pill × 3 times a day for 3 months, to be repeated after two-month break;

6. Milgamma – 1 pill × 3 times a day for 4 weeks, twice a year;

7. Cortexin – 10 mg per day intramuscularly, No. 5–10, to be repeated after 4–6 months;

8. Regular therapy depending on the state of the retina and vitreous body throughout the year.

The annual therapy, based upon sanitarium resort against the background of diabetes mellitus complications, allows most patients to maintain visual functions for a long time (5–10–15 years) and prevent, or delay, the proliferative stage.

Treating early and immature senile cataracts

It is well known that cataract is the most common ailment in people of the older age group among populations of all countries in the world. Patients with cataracts account for up to one third of people hospitalized in ophthalmology hospitals. They account for 35–40 % of all surgical interventions performed by ophthalmic surgeons, reaching 500–800 thousand annually [10]. Of all operated patients, 100–200 thousand develop complications, leading to a sharp decrease in visual function or even blindness [11, 12]. At the same time, modern cataract extraction is successful 95 % of the time, and is considered one of the safest and most effective eye surgeries. These findings both reflect and highlight the weakness of conservative treatment techniques used for early cataracts. There is also a group of patients, for whom surgery is contraindicated for various reasons. In this regard, the problem of cataracts has attracted the attention of many generations of ophthalmologists for many years.

In the Ophthalmology Division of the Piket Sanitarium on the basis of the Kislovodsk resort, a method of treating senile cataracts of the early and immature stages has been developed, which allowed to slow down the maturation process for a long period, with simultaneous therapy of concomitant somatic pathology provoking the development of cataracts.

The therapy of the early and immature stages of senile cataract was carried out in 1508 patients over time span of 3 years. Patients' age ranged from 45 to 85 years old: 802 men and 706 women. Of these, 1002 patients were admitted at later stages, while 506 people with the early cataract stage, with a visual acuity of at least 0.4–0.5. Biomicroscopy showed signs of the lens hydration: dehiscence of the cortex seams, dissociation of the cortex; subcapsular vacuoles, more pronounced under the anterior capsule, in the case of subcapsular cataract.

At the stage of immature cataract, 123 patients were admitted for treatment, with visual acuity from 0.1–0.3. Biomicroscopy revealed mixed opacities – the result of moving in the direction of the anterior and posterior capsules. In the case of a nuclear cataract, there were 8 patients with central opacities merging with the area of the senile nucleus.

All patients were divided into two groups:

1. Those who were treated for 21 days and stayed at the sanitarium, taking climatotherapy in the form of aerotherapy, balneotherapy in the form of Narzan mineral water baths (10 sessions), health path walks, therapeutic exercises, and treatment of all concomitant illnesses in the background of cataracts;

2. Patients who received solely outpatient eye therapy [12].

The results demonstrated that the effect of 10–15 procedures of ultrasonic irradiation with an intensity of 0.4 W/cm^2, a frequency of 880 KHz (an exposure of 5 minutes), in conditions of an acoustic contact *via* an isotonic sodium chloride solution, in a continuous mode, in a combination with an alternating 50-cycle magnetic field of a sinusoidal shape (exposure up to 20 minutes), had had a positive and stable healing effect.

The treatment course comprised of a regular annual repetition of therapy in accordance with described scheme for three years. The best treatment results were obtained in the group of patients, treated in a sanitarium. On the one hand, these results emphasized the need to consider senile cataract as one of the dysfunctions of an aging organism, burdened with numerous sicknesses requiring simultaneous therapy, along with the treatment of senile cataracts. On the other hand, they inspired optimism in terms of solving the problem of treating early and immature cataracts.

In cases of monitoring the patients, repeating the therapy course for 10 years (265 people), visual functions remained stable, and the state of the lens did not require its extraction [13].

Treating refractive errors

The main contemporary methods of treating myopia, hyperopia, and astigmatism include spectacle or contact lens correction and multiple surgical techniques with intervention into the sclera and cornea. The former is associated with the lifelong use of artificial optics and the weakening of own optical apparatus, the latter is linked to surgical intervention onto healthy tissues. The increase in the number of children with visual impairment due to the occurrence of refractive errors at the age of 7–16 years old (school age) alarms teachers and ophthalmologists, while unfavorable hygienic conditions for human eyes during schooling undoubtedly play a primary role in the etiology against the background of the spine pathology in the form of scoliosis, early osteochondrosis, birth trauma, posture disorders; chronic diseases of the upper respiratory tract, vegetative-vascular dystonia, metabolic disorders, consequences of head injuries, and of course, hereditary predisposition to myopia.

The data on therapeutic treatment of 1297 patients aged 4–18 years, with ametropia in the range of + (–) 4.0 diopters, are presented. The therapy was conducted for 12 days with a three-fold repetition after 6–8 months, over three years (observation period of eight years), in the form of electrical stimulation of the external oculomotor and ciliary muscles with a special ring-shaped electrode, in combination with ultrasonic stimulation of the eye nerves and muscles, using eye-training for 10 days. The therapy was aimed at restoring and stabilizing the harmonious relationship of the oculomotor muscles, ciliary muscle, lens and cornea, as the main components in the shear chain of the posterior major axis, presumably contributing to the appearance of ametropia. With ametropia above + (–) 3.0 diopters and astigmatism, laser stimulation of the retina with a helium-neon scanning laser beam, quantum color stimulation with Pankov's glasses and training of the accommodation apparatus with eye training devices were performed.

The effectiveness of treatment for myopia up to 3.0 diopters was 95 %. The first task in this case was to stop or slow down the progression of any stage at the time of treatment. With myopia over 3.0 diopters, the efficiency was 71 %. At myopia more than 6.0 diopters, the efficacy remained 58 %. Simultaneously, age, concomitant pathology, and heredity were taken into account. In conditions of astigmatism, the best persistent indicators of visual functions were noted with a mixed form of astigmatism at any age, however, depending on the initial ametropia of main meridians. With hyperopia over 4.0 diopters, visual acuity increased from 0.8 to 1.0. Skiascopy revealed ametropia of + 1.5–2.0 diopters.

Our data confirmed the understanding of ametropia + (–) 2.0 diopters as a biological variant of refraction as a result of the normal development of a growing eye, and of miscorrelation among the optical and anatomical components of the statistical refraction of the eye. At the same time, an improvement of visual functions and their stabilization against the background of a tendency towards emmetropization of refraction + (–) 2.0 diopters, as well as the accommodation dynamics, the positive part of the relative accommodation, changes in the horizontal anatomical parameters of the eye during therapy and three-year monitoring, do not exclude the assumption of their participation in the formation of emmetropia of the above mentioned structures.

The proposed therapy may be used in a complex of preventive measures for the progression of the ametropia degree, especially in conditions of myopia [13].

An increase in visual functions with a change in refraction along all meridians, with a tendency to emmetropia under astigmatism, also suggests the instability of this condition in childhood and the interest of the external oculomotor muscles in maintaining a certain radius of the cornea curvature, which requires further research and observation. Improvement and stabilization of visual acuity under myopia, hyperopia, or astigmatism, are facilitated by both ultrasonic and laser stimulation, included in the therapy course, as well as by balneotherapy in the form of carbon dioxide baths, aerotherapy, *terrain-cours*, and correction of concomitant somatic pathology. All of the above improve blood circulation in the retina, choroid, and ciliary muscle, stimulate photoreceptors of the macular region in the retina, and enhance the central fixation of the retina.

Conclusion

The Ophthalmology Division at the Piket Sanitarium, based on Kislovodsk health resort, is still the world only and unique ophthalmological resort, which has a contemporary logistics for the therapy and rehabilitation of patients with various pathologies of the organs of vision; with high efficiency of treating severe ophthalmic pathology of general medical and social significance. Also, the Ophthalmology Division has all necessary conditions for the development of scientific validity of the methods and the assessment of their effectiveness.

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