THE ROLE OF INFLAMMATORY PROCESSES IN THE DEVELOPMENT OF OPTIC NEURITIS: CLINICAL AND DIAGNOSTIC ASPECTS

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Abstract. *Currently, the number of working-age people suffering from hypertension, atherosclerosis, ischemic heart disease and diabetes mellitus has significantly increased. These diseases are often accompanied by circulatory disorders in the vessels of the retina and the vessels feeding the optic nerve, age-related degenerative changes, etc. A significant percentage of such patients become disabled. The most common underlying pathology in these diseases is ischemia.*

Keywords: *All ischemic processes in the eye, acute and chronic conditions.*

Introduction: The risk of developing ischemic conditions of the eye is determined by the anatomical features of the microcirculatory bed and, to a certain extent, depends on the degree of development of collateral blood circulation present in the prelaminar, laminar and postlaminar sections of the optic nerve [11, 15].

Currently, there is no classification of ocular ischemia. The close relationship between damage to various parts of the circulatory system, as well as the mechanisms of development of ischemia, does not allow a clear division of ischemic processes in the eye according to etiological and pathogenetic signs. Since ischemic diseases of the eye are polyetiological, have a diverse pathogenesis and a multifaceted clinical picture, it is difficult to imagine an ideal classification.

The only clear way to classify all ischemic processes in the eye into acute and chronic.

Dystrophic changes in the retina are among the most severe eye lesions. They occur in both young and old people and are often characterized by a progressive course, leading to a decrease in visual function and often disability.

The issue of classification of degenerations has not been finally resolved. Without discussing the existing classifications, it is recommended to take as a working option the proposal of Duke-Elder (1967), who divides all dystrophic changes in the retina into degenerations associated primarily with circulatory disorders in the choriocapillary layer and retinal blood vessels, and here are identified degenerations and degenerations. In the first group of diseases, chronic ischemia is the main pathogenetic link.

In the second group of retinal degenerations, the ischemic component is secondary. But it is very important to take into account its presence when choosing a treatment complex.

Among the severe degenerative, dystrophic changes in the retina are lesions of its macular region. Such lesions are observed in 25-40% of patients, more often in the elderly. This is explained by the fact that the macular region is usually in a worse nutritional state than the peripheral parts of the retina. In the pathogenesis of age-related macular degeneration, sclerotic changes in the choroidal vessels and hemodynamic shifts in the ophthalmic artery are of great importance, which can be observed both in arterial hypertension and in hypotension. Hoyng (1998) found that 1% of patients with central age-related macular degeneration become almost blind by the age of 65-74, with visual acuity of 0.01-0.02. In the age group over 85 years, the number of blind people among such patients reaches 11%.

An important problem is the treatment of glaucomatous optic atrophy. Most ophthalmologists believe that optic nerve atrophy is mainly associated with circulatory problems.

This problem is especially acute in the treatment of advanced glaucoma, when vascular diseases often accompany this eye disease (atherosclerosis, hypertension or diabetes mellitus) leading to an acute shortage of blood supply and complete exhaustion of compensatory abilities.

After surgical treatment, such patients often achieve normalization of IOP. However, long-term results of the study show that despite normalization of IOP, visual function continues to decline [1, 12].

Acute ischemia of the posterior segment of the eye manifests itself in the form of circulatory disorders in the central cerebral artery and its branches, anterior and posterior ischemic neuropathy. It can be a consequence of existing chronic ocular ischemia (diabetic or hypertensive angioretinopathy, degenerative changes in the retina, stenosis of the carotid, ophthalmic arteries, temporal arteritis). The basis of arterial blood flow disorders can also be general angiospastic diseases and eyeball injuries. Cases of ischemic neuropathy and circulatory disorders in the central coronary artery and its branches have been described against the background of hypotension, when taking certain medications, and after cardiac surgery (risk factors in this case are hypothermia, anemia, increased intraocular pressure, and microembolization) [31, 35].

Spontaneous recovery from ischemic neuropathy occurs in a small proportion of cases [29, 30]. Acute circulatory disorders in the retina and optic nerve almost always lead to partial loss of vision, and in some cases to complete blindness. The prognosis for vascular diseases of the optic nerve is always serious, but not hopeless. Sometimes, under the influence of treatment, there may be an improvement or stabilization of the disease process.

However, it is not always permanent, so repeated treatment in the form of regular courses is required. Visual acuity increases by 0.1-0.2, but in all cases, defects in the visual field remain.

When patients seek help late, visual acuity does not change or may even decrease. Often, ischemic optic vascular syndrome is a precursor to ischemic coronary or cerebral diseases and therefore requires long-term careful treatment not only of eye diseases, but also of associated diseases [22].

Questions on the pathophysiology of ischemic conditions of the eye

According to the functional principle of vascular bed classification, several groups of vessels are distinguished. The condition of each of them can affect the blood circulation of the eye [23]. The common carotid artery, which supplies blood to the orbit and eye, has high elasticity and belongs to the group of high-pressure vessels that convert the rhythmic outflow of blood into a uniform flow [9, 22].

Small arteries and veins (including the ophthalmic artery) are pressure stabilizers. They have a developed smooth muscle membrane, are slightly distensible, provide a certain basal tone, and respond to many, mainly local, factors that regulate regional blood flow.

The first and second order branches of the CAS, large choroidal arterioles, and ciliary arteries are the distributors of capillary blood flow, blocking blood flow in the capillary during contraction and restoring it when it relaxes.

The exchange function between blood and tissues is provided by exchange vessels - capillaries and postcapillary vessels. In this regard, they have important structural features. Retinal capillaries form an internal hematogenous barrier. The walls of the capillaries of the optic disc and retina are not fenestrated. They have a dense inner lining of endothelial cells, which allow only lipid-soluble substances (oxygen, CO2) to pass well. The transport of water-soluble structures is carried out by micropinocytic vesicles of the endothelium (by filling the endothelial pores with water). Of great importance for the functioning of the retina is the presence of two capillary networks: superficial, located in the nerve fiber layer, and deep, located between the inner core and outer plexiform layers. There are anastomoses between them [7].

To a large extent, the state of postcapillary resistance vessels affects the processes of microcirculation and transcapillary exchange. These include venules and capillaries. Active or passive changes in their lumen lead to blood pooling or its emergency release into the bloodstream.

In the retina, there is only one type of venous outflow. Especially in cases of impaired retinal blood circulation, shunt vessels, which are various anastomoses connecting arterioles and

venules, bypassing the capillary network, are of particular importance. They play an important role in the development of the "robbery" syndrome.

Research methods and materials: Three pathophysiological links can be identified in the development of vascular ischemic diseases of the eye [2, 20, 25].

• central circulatory disorders (heart disease, large vessels that maintain systemic blood pressure and its course). Among the etiological factors for the occurrence of acute ischemic conditions of the eye (ischemic neuropathy, circulatory disorders in the retinal vessels), hypertension and atherosclerosis occupy one of the first places [11, 33, 34]. These and other vascular diseases, as well as age-related weakening of cardiac activity, aggravate the course of glaucoma even with normalization of IOP. In ophthalmology, there is even an idea of the priority of the vascular factor in the development of glaucoma. Diseases of the heart and large vessels contribute to the development of optic nerve atrophy and age-related retinal degeneration.

• Circulatory disorders in organs and tissues (local, regional, peripheral). Ischemia (with arterial, venous hyperemia and stasis) is the most common form of regional circulatory pathology.

There are two main causes of ischemia: decreased arterial blood flow and increased tissue consumption of oxygen and metabolic substrates transported by the blood. Ocular ischemia is usually caused by inadequate blood flow, which may be due to one or more mechanisms. There are three mechanisms that most often lead to decreased blood flow:

1. Neurogenic. Vasoconstriction occurs against the background of the predominance of sympathoadrenal effects on arterioles and precapillaries (stress), as well as due to a decrease in the activity of parasympathetic effects on arterioles (neuroparalytic ischemia).

2. The humoral mechanism of arteriolar constriction is associated with the presence of agents that have a vasoconstrictor effect in tissues (angiotensin II, vasopressin, catecholamines) and (or) an increase in the sensitivity of the vascular wall to them (with the accumulation of sodium and calcium ions in it).

3. The “mechanical” origin of ischemia is associated with the presence of an obstacle to blood flow through the arterioles: a) compression of the vessel (tumor, scar, tissue swelling, rarely - prolonged compression of the central retinal artery or optic nerve as a result of operations performed during retinal detachment or scleroplasia of the optic disc during deformation of the cribriform plate in glaucoma, b) reduction in the lumen of the arterioles until complete closure (embolism, thrombus, blood cell aggregate) [20].

• Violation of blood circulation in the vessels of the microcirculatory bed (arterioles, precapillaries, capillaries, postcapillaries, venules and arteriovenous shunts). Microcirculation is

understood as the orderly movement of blood and lymph through microvessels, the transcapillary exchange of oxygen, carbon dioxide, substrates and metabolic products, ions, biologically active substances, as well as the movement of fluids in the vascular space [20]. Due to the presence of a very extensive network of small-caliber vessels and precapillary sphincters, the conditions of blood circulation in the microcirculatory bed (MCB) have their own characteristics. In addition, the diameter of the capillaries does not correspond to the size of erythrocytes [7, 14]. As a result, the resistance to blood flow in the microcirculatory system is largely determined by the state of the precapillary sphincters and the rheological properties of the blood.

The consequences of ischemia are hypoxia, excess products of impaired metabolism, ions and some biologically active substances (lactic acid, thromboxane A, free radicals, calcium ions) accumulated in ischemic tissues. This leads to a decrease in the functions of specific organs, a decrease in non-specific functions and processes (local protective reactions, cell proliferation and differentiation), the development of dystrophic processes, tissue hypotrophy and atrophy [20].

However, the outcome and nature of the consequences of ocular ischemia can be different and depend on a number of factors. The most important factors for the eye are the rate of development of ischemia, the diameter of the affected artery or arteriole, the state of the vascular network of the eye (the presence of angiosclerosis, involution processes in the vascular wall), as well as the degree of development of collateral vessels and the rate of activation of collateral blood circulation.

The introduction of collateral circulation is facilitated by the presence of proximal and distal pressure gradients in the narrowed area, the accumulation or introduction of biologically active substances with vasodilatory effects into the ischemic zone, and the degree of development of the vascular network in the affected eye.

The treatment of ischemic conditions of the eye is sufficiently covered in the literature for such diseases as glaucoma (compensated), age-related central retinal degeneration, anterior and posterior ischemic neuropathy, circulatory disorders in the branches of the central retinal artery, vascular atrophy of the optic nerve. The most advanced methods of conservative treatment include drug therapy and physiotherapy. However, in this article we would like to analyze the existing methods of surgical treatment of ischemic diseases of the optic nerve and retina.

The instability and short-term effect after the combined use of vasodilators with other drugs and physiotherapeutic methods of treatment led ophthalmologists to search for more stable methods of improving blood circulation in the eye.

Various surgical methods have been developed to correct circulatory disorders in the eye. All operations to improve hemodynamics of the retina and optic nerve are divided into three groups [3]:

I. Methods for posterior ocular revascularization using extraocular muscles, episcleral tissue, and Tenon's space implants.

II. Operations on the vessels involved in the blood supply to the eye.

• By redistributing blood flow in the internal carotid artery and ophthalmic artery basin.

• By slowing the outflow of venous blood - phlebodestruction.

III. Decompression surgery on the optic nerve.

Revascularization of the posterior segment of the eye

Results: Choroid revascularization has been widely used by many ophthalmologists. There are many modifications of these operations, the general direction of which is the creation of additional collateral blood supply to the inner membranes of the eye. Operations have been performed using the oculomotor muscles and the episcleral flap [5, 10]. In degenerative diseases of the retina, chondroplasty using autologous cartilage from the patient's auricle has also been used.

VS Belyaev (1983) introduced donor sclera segments into the Tenon space with simultaneous microdiathermocoagulation of the recipient sclera, which subsequently contributed to thinning of the sclera and the appearance of newly formed vessels.

The stimulating effect of materials introduced into the Tenon space is explained by the release of vasoactive and other physiologically active substances (histamine, serotonin, kinins, lysosomal enzymes, etc.). The development of the immune response leads to increased vascularization of the optic nerve and other tissues of the eye. The formation of bradykinin and histamine leads to vasodilation and an increase in local blood flow. At the same time, mast cells begin to produce heparin, which has a beneficial effect on microcirculation [4]. Morphological studies have confirmed the presence of a large number of newly formed capillaries in the episclera, optic nerve sheath, and other tissues of the eye in the surgical area [3, 4].

For local administration of drugs to the posterior segment of the eye, mainly retrobulbar injections or electrophoresis are used. In this case, a significant part of the administered drug is absorbed into the capillaries of the orbital fat tissue and enters the general vascular bed. Due to the painfulness of the procedure, it is not recommended to administer drugs retrobulbar several times a day, in addition, there is a risk of hematoma or damage to the optic nerve or eyeball with the injection needle;

To maintain a high concentration of the drug in direct contact with the sclera and optic nerve head in the posterior segment of the AP, Nesterov and SN Basinsky proposed the introduction of a collagen infusion system into the Tenon space [3, 18, 19].

Collagen is the main structural protein of connective tissue and is insoluble in common solvents. In medicine, film and spongy collagen materials are most often used for wound closure.

Medical and biological studies of collagen preparations have revealed a number of their valuable properties: non-toxicity, lack of local tissue sensitivity, and reduced likelihood of allergic reactions due to low antigenicity. The excellent compatibility of collagen with various medicinal substances allows obtaining drugs and materials with targeted effects [19].

Sub-Tenon's Collagen Infusion System (SCI) implantation involves injecting the necessary medication directly into the posterior pole of the eye 2-3 times a day using a silicone tube sewn into the collagen graft.

Discussion: The surgical technique has been described previously and consists of two steps. A graft measuring 30 mm long and 8 mm wide is created from a standard sterile collagen sponge of 10 mm thickness (Figure 1). A portion of the collagen sponge is soaked in saline, squeezed out, and folded in half. One end of a 10–12 cm long and 1–1.5 mm diameter polyethylene tube is inserted into the wrapped sponge and sutured with 8/0 mattress suture to allow the thread to pass through the tube. The opening at the other end of the tube is tightly closed with a sterile stopper (Figure 2).

In the upper outer quadrant, the conjunctiva and Tenon's capsule are incised 6-7 mm from the limbus. Using a spatula, a channel is created through the incision in the Tenon's space to the posterior pole of the eye (Figure 3). The prepared infusion system is inserted into the formed channel (Figure 4). A continuous suture is placed at the incision site of the conjunctiva and capsule.

The removed tube is secured to the skin of the forehead with adhesive tape (Figure 5).

In SICS, the drug administered through the tube moistens the pores of the sponge and partially diffuses into the Tenon space. The porous structure of the sponge provides the creation of a kind of reservoir. **Conclusion:** In addition, there is evidence of a long-term effect of the collagen sponge on the action of drugs [7, 10]. The presence of a tube allows for the administration of drugs 2 or more times a day.

The duration of treatment with SICS can be up to 10-14 days, provided that the sterility of the tube itself is maintained. At the end of treatment, the tube is easily removed by pulling it from the outer end. Suturing the conjunctival area is not required.

In patients with optic nerve atrophy and retinal pigment abiotrophy, the SIKIS method has been shown to improve visual function in most cases within the first few days after surgery [18, 19]. Visual function has stabilized over the next 6 months. SIKIS can be repeated, but not earlier than 2-3 months after the previous operation.

List of used literature:

1. БЕЛКА, F. S. P. C. P. (2022). В ПАТОГЕНЕЗЕ СОСУДИСТЫХ ЗАБОЛЕВАНИЙ ОРГАНА ЗРЕНИЯ У БОЛЬНЫХ АРТЕРИАЛЬНОЙ ГИПЕРТЕНЗИЕЙ.
2. Жалалова, Д. З., Кадирова, А. М., & Хамракулов, С. Б. (2021). Исходы герпетических кератоувеитов на фоне лечения препаратом «офтальмоферон» в зависимости от иммунного статуса пациентов. междисциплинарный подход по заболеваниям органов головы и шеи, 103.
3. ЖД, З., and А. БС. "РЕЗУЛЬТАТЫ ОЦЕНКИ УРОВНЯ ЭНДОТЕЛИНА-1 И Д-ДИМЕРОВ В СЛЕЗНОЙ ЖИДКОСТИ У ПАЦИЕНТОВ С АРТЕРИАЛЬНОЙ ГИПЕРТЕНЗИЕЙ." SCIENTIFIC JOURNAL OF APPLIED AND MEDICAL SCIENCES 3.3 (2024): 300-307.
4. Zhalalova, D. Z. OCT angiography in the assessment of retinal and choreoretinal microcirculation in patients with uncomplicated arterial hypertension International Ophthalmological Congress IOC Tashkent 2021.
5. Zhalalova, D. Z. Evaluation of markers of endothelial dysfunction in tear fluid in patients with arterial hypertension. Journal of Biomedicine in Amaliet. Tashkent-2022, Volume No., No. WITH.
6. Жалалова, Д. З. (2021). Эндотелин-1 ва гомоцистеин даражасини артериал гипертензия фонида тур пардв узгаришларида эндотелиал дисфункциянинг маркерлари сифатида текшириш. Биомедицина ва амалиет журнали, 6(5), 203-210.
7. Jalalova, D., Axmedov, A., Kuryazov, A., & Shernazarov, F. (2022). Combined dental and eye pathology. Science and innovation, 1(8), 91-100.
8. Zhalalova, D. Z. (2022). Pulatov US MICROCIRCULATORY DISORDERS IN THE VASCULAR SYSTEM OF THE BULBAR CONJUNCTIVA WITH INITIAL MANIFESTATIONS OF INSUFFICIENT BLOOD SUPPLY TO THE BRAIN. European journal of molecular medicine, 2(5).
9. Жалалова, Д. З. (2021). ОКТ-ангиография при оценке сосудистого русла сетчатки и хориоидеи. Биология ва тиббиет муаммолари, 6(130), 211-216.

10. Жалалова, Д. З. (2022). Классификационые критерии изменений сосудов сетчатки при артериальной гипертензии. In Международная научная конференция Университетская наука: взгляд в будущее (pp. 56-64).
11. Долиев, М. Н., Тулакова, Г. Э., Кадырова, А. М., Юсупов, З. А., & Жалалова, Д. З. (2016). Эффективность комбинированного лечения пациентов с центральной серозной хориоретинопатией. Вестник Башкирского государственного медицинского университета, (2), 64-66.
12. Жалалова, Д. З. Оценка маркеров эндотелиальной дисфункции в слезной жидкости у пациентов с артериальной гипертензиейЖурнал «Биомедицина ва амалиет». Тошкент-2022, Том №, №. С.
13. Жалалова, Д. З. (2021). ОКТ-ангиография в оценке ретинальной и хореоретинальной микроциркуляции у пациентов с неосложненой артериальной гипертензией/I Международный офтальмологческий конгресс IOC Uzbekistan, 2021 г. Ташкент, с, 96.
14. Shernazarov, F., Jalalova, D., Azimov, A., & CAUSES, S. A. (2022). SYMPTOMS, APPEARANCE, TREATMENT OF VARICOSE VEINS.
15. Жалалова, Д. З. (2021). Эндотелин-1 ва гомоцистеин даражасини артериал гипертензия фонида тур пардв узгаришларида эндотелиал дисфункциянинг маркерлари сифатида текшириш. Биомедицина ва амалиет журнали, 6(5), 203-210.
16. Shernazarov, F., Tohirova, J., & Jalalova, D. (2022). Types of hemorrhagic diseases, changes in newboens, their early diagnosis. Science and innovation, 1(D5), 16-22.
17. Zhalalova, D. Z. (2022). The content of endothelin and homocysteine in blood and lacrimal fluid in patients with hypertensive retinopathy Web of Scientist: International Scientific Research Journal. ISSUE, 2, 958-963.
18. Shernazarov, F., & Zuhridinovna, J. D. (2022). Microcirculation disorders in the vascular system of the bulbar conjunctiva in the initial manifestations of cerebral blood supply deficiency. Science and innovation, 1(Special Issue 2), 515-522.
19. Zhalalova, D. Z. (2022). Modern aspects of neuroprotektive treatment in hypertensive retinopathy Web of Scientist: International Scientific Research JournalVolume 3. ISSUE, 2, 949-952.
20. Жалалова, Д. З. (2009). Метод комбинированного лечения диабетической ретинопатии. Врач-аспирант, 37(10), 864-868.

21. Жалалова, Д. З. (2023). Результаты оценки эффективности комплексного лечения у пациентов с 3-4 стадиями гипертонической ангиоретинопатии. Miasto Przyszłości, 41, 33-36.
22. ЖД, З., & ИЖ, Ж. (2024). КЛАССИФИКАЦИЯ ГИПЕРТОНИЧЕСКОЙ РЕТИНОПАТИИ НА ОСНОВЕ ДАННЫХ ОПТИЧЕСКОЙ КОГЕРЕНТНОЙ ТОМОГРАФИИ. SCIENTIFIC JOURNAL OF APPLIED AND MEDICAL SCIENCES, 3(3), 336-342.
23. ЗЖД, Ж. (2024). КЛИНИКО-ФУНКЦИОНАЛЬНЫЕ ПОКАЗАТЕЛИ ОРГАНА ЗРЕНИЯ У ПАЦИЕНТОВ С ИШЕМИЧЕКИМИ ИЗМЕНЕНИЯМИ СОСУДОВ СЕТЧАТКИ. SCIENTIFIC JOURNAL OF APPLIED AND MEDICAL SCIENCES, 3(3), 286-293.
24. ЖД, З. (2024). ОЦЕНКА КЛИНИЧЕСКИХ И ФУНКЦИОНАЛЬНЫХ ПОКАЗАТЕЛЕЙ ЭНДОТЕЛИАЛЬНОЙ ДИСФУНКЦИИ В СЛЕЗНОЙ ЖИДКОСТИ У ПАЦИЕНТОВ С АРТЕРИАЛЬНОЙ ГИПЕРТЕНЗИЕЙ. SCIENTIFIC JOURNAL OF APPLIED AND MEDICAL SCIENCES, 3(3), 330-335.
25. Жалалова, Д. З. (2023). Актуальность проблемы изменений глазного дна при артериальной гипертензии. Miasto Przyszłości, 41, 37-40.