METHOD OF TREATMENT OF ISCHEMIC CONDITIONS OF THE OPTIC NERVE AND RETINA (LITERATURE REVIEW)

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Abstract. *In this article, the number of people of working age with hypertension, atherosclerosis, cardiovascular diseases and diabetes has increased significantly. General characteristics of ischemic eye diseases. Currently, there is no classification of eye ischemia. The article provides detailed information about ischemic processes in the eye, eye diseases and their causes and prevention in view of the existence of a close connection between injuries of various parts of the circulatory system, as well as mechanisms of ischemia development.*

Keywords*: hypertension, atherosclerosis, cardiovascular diseases, diabetes, prevention, health.*

СПОСОБ ЛЕЧЕНИЯ ИШЕМИЧЕСКИХ СОСТОЯНИЙ ЗРИТЕЛЬНОГО НЕРВА И СЕТЧАТКИ (ЛИТЕРАТУРНЫЙ ОБЗОР)

Аннотация. *В данной статье значительно увеличилось количество лиц трудоспособного возраста с гипертонией, атеросклерозом, сердечно-сосудистыми заболеваниями и сахарным диабетом. Общая характеристика ишемической болезни глаз. В настоящее время не существует классификации ишемии глаза. В статье представлена подробная информация об ишемических процессах в глазу, заболеваниях глаз, их причинах и профилактике ввиду наличия тесной связи между повреждениями различных отделов системы кровообращения, а также механизмов развития ишемии.*

Ключевые слова: *артериальная гипертензия, атеросклероз, сердечно-сосудистые заболевания, сахарный диабет, профилактика, здоровье.*

INTRODUCTION

Currently, there is a significant increase in the number of people of working age suffering from hypertension, atherosclerosis, coronary artery disease and diabetes mellitus. These diseases are often accompanied by circulatory disorders in the vessels of the retina and vessels that feed the optic nerve, age-related dystrophic changes, etc.

MATERIALS AND METHODS

General characteristics of ischemic diseases of the eye.

Classification of ischemia of the eye does not currently exist. The presence of a close relationship between lesions of various parts of the circulatory system, as well as between the mechanisms of development of ischemia, does not allow a clear division of ischemic processes in the eye according to etiological and pathogenetic features. Due to the fact that ischemic diseases of the eye are polyetiological, have different pathogenesis and a diverse clinical picture, it is difficult to imagine a perfect classification.

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

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

The question of the classification of degenerations has not been finally resolved. Without going into a discussion of existing classifications, it is advisable to take as a basis the suggestion of Duke-Elder (1967), which divides all dystrophic changes in the retina into degenerations that are primarily associated with impaired vascular circulation in the choriocapillary layer and retinal vessels, and hereditarily determined lesions 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 when choosing a treatment complex, it is very important to take into account its presence. Acute ischemia of the posterior segment of the eye manifests itself in the form of circulatory disorders in the CAS and its branches, anterior and posterior ischemic neuropathy. It may be the result of already existing chronic ischemia of the eye (diabetic or hypertensive angioretinopathy, degenerative changes in the retina, stenosis of the carotid, ophthalmic artery, temporal arteritis).

Arterial blood flow disorders can also be based on general angiospastic diseases, injuries of the eyeball. Cases of the development of ischemic neuropathy and circulatory disorders in the CAS and branches on the background of hypotension, taking certain medications, and after heart surgery are described (predisposing risk factors in this case are hypothermia, anemia, increased IOP, and microembolization) [31, 35].

The prognosis for vascular diseases of the optic nerve is always serious, but not hopeless. Sometimes, under the influence of treatment, an improvement or stabilization of the disease process may occur. However, it is not always persistent, so repeated treatment is required in the form of regular courses. Visual acuity increases by 0.1–0.2, but in all cases defects remain in the field of view. With late treatment of patients, visual acuity does not change or may even decrease. Often, ischemic optic-vascular syndrome is a harbinger of ischemic coronary or cerebral incidents and therefore requires careful long-term treatment not only of the eye disease, but also of its concomitant diseases [22].

Issues of pathophysiology of ischemic conditions of the eye.

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

Small arteries and veins (the ophthalmic artery can be attributed to them) are pressure stabilizers. They have a developed smooth muscle membrane, little stretch, providing a certain basal tone, responding to numerous, mostly local, factors of regional blood flow regulation.

The branches of the CAS of the first and second order, large choroidal arterioles, ciliary arteries, being distributors of capillary blood flow, block the blood flow in the capillary during contraction and resume it when relaxed.

RESULTS

The function of exchange between blood and tissues is provided by exchange vessels - capillaries and post-capillary veins. In this regard, they have significant structural features.

Retinal capillaries create an internal hematic barrier. The walls of the capillaries of the optic disc and the retina are not fenestrated. They have a dense inner lining of endothelial cells, which allow only fat-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 that it has two capillary networks: superficial, located in the layer of nerve fibers, and deep, located between the inner nuclear and outer plexiform layers. There are anastomoses between them [7].

To a large extent, the state of post-capillary resistance vessels affects microcirculation and the processes of transcapillary exchange. These include venules and small veins. Active or passive changes in their lumen lead to the accumulation of blood or to its emergency release into the circulation. The retina has only a venous outflow type.

Shunting vessels, which are various types of anastomoses that connect arterioles and venules, bypassing the capillary network, are of particular importance, especially in violation of blood circulation in the retina. They play a significant role in the development of the “steal” syndrome.

Three pathophysiological links can be distinguished in the development of vascular ischemic diseases of the eye [2, 20, 25].

• Violations of the central circulation (caused by diseases of the heart, large vessels, which ensure the maintenance of systemic blood pressure, the direction of its movement). One of the first places among the etiological factors for the occurrence of acute ischemic conditions of the eye (ischemic neuropathy, circulatory disorders in the vessels of the retina) is occupied by hypertension and atherosclerosis [11, 33, 34]. These and other vascular diseases, as well as age-related weakening of the heart, aggravate the course of glaucoma even with normalization of IOP. In ophthalmology, there is even a concept about the primacy of the vascular factor in the development of glaucoma. Diseases of the heart and large vessels can contribute to optic nerve atrophy and age-related retinal degeneration.

• Violation of organ-tissue circulation (local, regional, peripheral). Ischemia (along with arterial, venous hyperemia and stasis) is the most common form of regional circulation pathology.

There are two main reasons for the development of ischemia - a decrease in arterial blood flow and an increase in tissue consumption of oxygen and metabolic substrates transported by the blood. Ischemia of the eye is usually caused by insufficient blood flow, which may be the result of one or more mechanisms. Three mechanisms most commonly lead to decreased blood flow:

1. Neurogenic. Vasoconstriction occurs against the background of the predominance of sympathoadrenal influences on arterioles and precapillaries (stress), as well as due to a decrease in the activity of parasympathetic influences on arterioles (neuroparalytic ischemia).
2. The humoral mechanism of arteriolar constriction is associated with an increase in the content of agents with a vasoconstrictor effect in tissues (angiotensin II, vasopressin, catecholamines) and (or) with an increase in the sensitivity of the vascular wall to them (with the accumulation of sodium and calcium ions in it).
3. The "mechanical" genesis of ischemia is due to the presence of an obstacle to blood flow through the arterioles due to: a) vessel compression (tumor, scar, tissue edema, rarely - prolonged compression of the CAS or the optic nerve, as a result of operations for retinal

detachment with circling or scleroplasty about myopia), as well as compression of vessels in the optic disc during deformation of the cribriform plate in glaucoma, b) reduction in the lumen of arterioles, up to complete closure (embolism, thrombus, aggregate of blood cells) [20].

• Violation of blood circulation in the vessels of the microvasculature (occurs in arterioles, precapillaries, capillaries, postcapillaries, venules and arteriovenular shunts). Microcirculation is understood as the ordered 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 extravascular space [20]. The conditions of blood circulation in the microcirculatory bed (MCR) have their own characteristics due to the presence of an extremely extensive network of small vessels and precapillary sphincters. Moreover, the diameter of the capillaries does not correspond to the size of the erythrocyte [7, 14]. As a result, the resistance to blood flow in the MCR is largely determined by the state of the precapillary sphincters and the rheological properties of the blood.

The consequences of ischemia are hypoxia, an excess of metabolic products, ions and some biologically active substances that accumulate in ischemic tissue (lactic acid, thromboxane A, free radicals, calcium ions). This leads to a decrease in the specific functions of the organ, a decrease in nonspecific functions and processes (local defense reactions, cell proliferation and differentiation), the development of dystrophic processes, hypotrophy and atrophy of tissues [20].

Methods of treatment of ischemic conditions of the eye.

The issues of treatment of ischemic conditions of the eye are sufficiently covered in the literature in relation to such diseases as glaucoma (compensated), age-related central retinal degeneration, anterior and posterior ischemic neuropathy, circulatory disorders in the branches of the CAS, atrophy of the optic nerve of vascular origin. The most developed methods of conservative treatment, which include pharmacotherapy and physiotherapy. But in this article we want to analyze the existing methods of surgical treatment of ischemic diseases of the optic nerve and retina.

The instability and short duration of the effect after the use of vasodilator drugs in combination with other drugs and physiotherapeutic methods of treatment led ophthalmologists to look for more stable ways to improve blood circulation in the eye. Various surgical methods have been developed to correct impaired blood circulation in the eye. All operations to improve the hemodynamics of the retina and optic nerve are divided into three groups [3]:

- I. Methods for revascularization of the posterior part of the eye using oculomotor muscles, episcleral tissue and implants in the Tenon's space.
- II. Operations on the vessels involved in the blood supply to the eye.
- • By redistributing blood flow in the basin of the internal carotid artery and the ophthalmic artery.
- • By slowing down the outflow of venous blood - phlebodestruction.
- III. Decompression surgery on the optic nerve.

Revascularization of the posterior eye

DISCUSSION

Many ophthalmologists have widely used choroid revascularization. There are many modifications of these operations, the general direction of which is to create an additional collateral blood supply to the inner membranes of the eye. Operations were performed using the oculomotor muscles and an episcleral flap [5, 10]. In dystrophic diseases of the retina, chondroplasty was also used using autocartilage of the patient's auricle.

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

In order to maintain a high concentration of the drug in direct contact with the vessels of the sclera and optic nerve in the posterior segment, A.P. Nesterov and S.N. 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, insoluble in common solvents. In medicine, membranous and spongy collagen materials are most widely used as wound dressings. Sub-Tenon implantation of a collagen infusion system (SIKIS) means that with the help of a silicone tube sewn to a collagen graft, it is possible to inject the necessary drugs directly to the posterior pole of the eye 2-3 times a day.

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

Methods for redistributing blood flow in the eye

For the first time, this type of operation was proposed in 1968 and consisted of ligation of the external carotid artery. This led to an increase in the main blood flow in the ophthalmic artery, an increase in the blood filling of the choroid and activation of metabolic processes in the retina and optic nerve.

However, this operation had a number of serious drawbacks: the impossibility of performing it in case of damage to the internal carotid artery, a large blood pressure in the internal carotid artery system after the operation, and the need to use carotid angiography [3]. Therefore, operations were developed to cut the branches of the ophthalmic artery, as well as the superficial temporal and angular arteries (a branch of the external carotid artery) [27].

Studies have shown the possibility of improving and stabilizing visual functions in patients with various forms of vascular pathology. However, performing vasoreconstructive operations is advisable in a certain group of patients and depends on the data of Doppler ultrasound and fluorescein angiography [27]. If the blood supply to the eye is normal or the compression test does not increase the blood flow in the ophthalmic artery, then this surgical intervention is not indicated. The severity of the effect of the operation and the stability of the results depend on the stage of the disease. In 1984, M. Bonnet published works in which he proposed the operation of ligation of vorticose veins in retinal dystrophies. The operation began to be used in Russia, with a positive effect.

The purpose of the operation is to create conditions for a slower passage of arterial blood through the system of precapillary arterioles by phlebodestruction in order to improve its irrigation of the macular zone, which leads to a longer contact of erythrocytes with the endothelium of the choriocapillaries.

CONCLUSIONS

Thus, evaluating the literature data on the treatment of ischemic diseases of the optic nerve and retina, it should be noted that there are a number of issues in this area that require further study. The search for the most effective vasoactive drugs with minimal side effects

continues. Many ophthalmologists pay great attention to the improvement of old and the development of new methods of surgical treatment of ischemic processes in the eye. The use of a number of techniques in the complex treatment of ischemia and its consequences (hypoxia, excess metabolic products, tissue degeneration) improves the hemodynamics of the eye and preserves visual functions.

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