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Optic Nerve Atrophy Caused by Increased Intraocular Pressure and its Role in the Development of Glaucoma

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Abstract: This article analyzes optic nerve atrophy resulting from increased intraocular pressure (IOP) and its role in the pathogenesis of glaucoma. Glaucoma is considered the most common cause of irreversible blindness worldwide. Studies show that elevated IOP leads to mechanical compression at the optic nerve head, impaired blood circulation, and neurodegenerative processes that result in the loss of retinal ganglion cells. This paper discusses the pathophysiological mechanisms of the disease, diagnostic methods, and modern neuroprotective approaches. The aim of this article is to scientifically analyze the role of optic nerve atrophy caused by elevated IOP in the development of glaucoma, to highlight its pathogenetic mechanisms, and to review modern diagnostic and therapeutic strategies.

Keywords: Glaucoma, intraocular pressure, optic nerve atrophy, neurodegeneration, ischemia, neuroprotection, modern diagnostics, World Health Organization, etiological factor, open-angle, closed-angle.

Introduction: Glaucoma (from the Greek *"glaucos"* — light blue, blue-green color) or "blue water" is an eye disease characterized by elevated intraocular pressure, narrowing of the visual field, and damage to the optic nerve disc. Glaucoma is a chronic disease in which elevated intraocular pressure causes the degeneration of optic nerve fibers, and it remains the leading cause of irreversible blindness worldwide. Optic nerve atrophy is the central link in the pathogenesis of glaucoma, being closely associated with intraocular pressure, impaired blood circulation, and neurodegenerative processes. This paper examines optic nerve atrophy caused by increased intraocular pressure and its role in the development of glaucoma.

Glaucoma is a chronic progressive degenerative disease of the optic nerve characterized by gradual loss of visual field and visual acuity. According to the World Health Organization (WHO), more than 70 million people suffer from glaucoma globally, and about 10 million of them are completely blind. One of the main etiological factors in glaucoma pathogenesis is the increase in intraocular pressure (IOP). The physiological norm of IOP ranges between 10–21 mmHg, determined mainly by the balance between the production and outflow of aqueous humor. Elevated IOP increases mechanical pressure at the optic nerve head, leading to compression of optic nerve fibers, impaired blood supply, and subsequent atrophic changes. Glaucoma can be classified into primary, secondary, and other forms.

Primary glaucoma occurs independently, primarily due to impaired outflow of intraocular fluid and increased intraocular pressure. This type is most common in individuals over 35–40 years old. Depending on the condition of the anterior chamber angle, it can be divided into **open-angle**, **closed-angle**, and **mixed** forms.

Closed-angle glaucoma usually manifests with severe unilateral eye pain, headache on the affected side, blurred vision, and the appearance of rainbow-colored halos around lights. Subsequently, pain in the eye and forehead intensifies, accompanied by dizziness, nausea, redness, and tearing of the eye. The anterior eye vessels dilate, the cornea becomes cloudy, the pupil enlarges, and light adaptation is lost. Intraocular pressure rises sharply, the eyeball becomes hard, and an acute attack develops.

Open-angle glaucoma often progresses silently over a long period. The intraocular pressure gradually increases, but there is no pain, and the affected eye appears normal. As pressure rises, blood flow in the optic nerve and retina is disrupted, leading to narrowing of the visual field and decreased vision. **Mixed-angle glaucoma** is diagnosed using gonioscopy.

Secondary glaucoma arises as a consequence of other ocular diseases (uveitis, lens pathology, vascular disorders, ocular trauma, dystrophy, or tumors). **Congenital and juvenile glaucoma** develop due to malformation of the anterior chamber angle or structural defects in ocular tissues.

Normal intraocular pressure usually ranges from 18–26 mmHg. If the level exceeds 26 mmHg, glaucoma should be suspected and confirmed through specific diagnostic tests. To prevent the disease, people over 40 years of age should have their intraocular pressure measured at least once a year. In case of eye or head pain, or decreased vision, immediate consultation with an ophthalmologist is essential.

Glaucoma progresses through **four stages**: initial, developed, advanced, and terminal. During an acute attack, local and systemic medications are prescribed to reduce intraocular pressure. If the pressure remains elevated for more than 24 hours, surgical intervention should be considered. Initially, treatment involves medications; however, if pressure remains uncontrolled or visual field loss continues, **laser** or **microsurgical operations** are performed. Early treatment can significantly preserve vision.

Patients with glaucoma are advised to follow a **special diet and lifestyle**: consume more dairy products and vegetables, avoid working at night or in dim lighting, rest regularly, and avoid physical or emotional stress. They should also refrain from bending their heads while working, excessive fluid intake, strong tea, coffee, and alcohol.

Regular ophthalmologic examinations and dispensary observation are essential for **early diagnosis and effective treatment**. Glaucoma, characterized by elevated intraocular pressure, is a serious disease. The main goal of glaucoma treatment is to **prevent glaucomatous changes and optic nerve damage** while maintaining the patient's visual field and quality of life. Therefore, accurate diagnosis and individualized therapy are crucial. Although intraocular pressure is a key risk factor, reducing it pharmacologically or surgically remains the main treatment strategy.

Studies have shown that, for example, marijuana may lower intraocular pressure. In patients with primary open-angle glaucoma and ocular hypertension, IOP-lowering therapy helps slow the progression of visual field loss. Moreover, theories focused on vascular flow and neurodegenerative mechanisms have led to the exploration of **neuroprotective therapies**, including nutritional supplements—some of which have been proven safe in clinical practice, while others are still under investigation. Since psychological stress may also contribute to visual impairment, **stress management techniques** such as autogenic training and relaxation exercises are beneficial.

Conclusion

Optic nerve atrophy is the main pathogenetic link in the development of glaucoma. Mechanical and ischemic changes resulting from elevated intraocular pressure lead to degeneration of optic nerve cells. Therefore, in glaucoma diagnosis, it is essential not only to measure intraocular pressure but also to thoroughly examine the condition of the optic nerve. Modern neuroprotective treatment approaches help protect the optic nerve and reduce vision loss. Both

laser and conventional surgical methods are used in glaucoma treatment. For congenital glaucoma, surgery remains the primary therapy. However, these procedures are generally temporary solutions, as there is currently **no definitive cure for glaucoma**.

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