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ADVANCEMENTS IN THE COMPREHENSIVE TREATMENT OF PATIENTS WITH PRIMARY OPEN-ANGLE GLAUCOMA

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Abstract. *The development of primary open-angle glaucoma (POAG) is currently considered to be a chain of interaction between etiological and pathogenetic factors, among which the leading role is played by genetic predisposition, general changes, ischemia, primary local functional and dystrophic changes, disturbances in hydrostatics and hydrodynamics of the eye, increased intraocular pressure, vascular disorders, dystrophy and tissue degeneration. Purpose. The purpose of this study is to study the factors of endothelial dysfunction leading to a decrease in ocular hemoperfusion in patients with primary open-angle glaucoma. Methods. The study included 92 patients with POAG, aged 65 to 80 years. The level of lipid peroxidation and AOS, the lipid composition of the blood and the indicators of the complement system were studied before and after treatment. Conclusion. The study of indicators of oxidative stress and antioxidant status of blood serum according to the corresponding levels (high, medium and low) makes it possible to determine the risk of disease progression and evaluate the effectiveness of treatment in patients with POAG.*

Key words: *optical coherence tomography angiography, primary open-angle glaucoma, microcirculation of the retina and optic nerve head.*

ДОСТИЖЕНИЯ В КОМПЛЕКСНОМ ЛЕЧЕНИИ БОЛЬНЫХ С ПЕРВИЧНОЙ ОТКРЫТОУГОЛЬНОЙ ГЛАУКОМОЙ

Аннотация. *Развитие первичной открытоугольной глаукомы (ПОУГ) в настоящее время рассматривается как цепь взаимодействия этиологических и патогенетических факторов, среди которых ведущую роль играют генетическая предрасположенность, общие изменения, ишемия, первичные локальные функционально-дистрофические изменения, нарушения гидростатики и гидродинамики глаза, повышение внутриглазного давления, сосудистые нарушения, дистрофия и дегенерация тканей. Цель. Целью настоящего исследования является изучение факторов эндотелиальной дисфункции, приводящих к снижению глазной гемоперфузии у больных первичной открытоугольной глаукомой. Методы.*

В исследование включено 92 пациента с ПОУГ в возрасте от 65 до 80 лет. Изучали уровень перекисного окисления липидов и АОС, липидный состав крови и показатели системы комплемента до и после лечения. Заключение. Исследование показателей оксидантного стресса и антиоксидантного статуса сыворотки крови по соответствующим уровням (высокий, средний и низкий) позволяет определить риск прогрессирования заболевания и оценить эффективность лечения у больных ПОУГ.

Ключевые слова: *оптическая когерентная томографическая ангиография, первичная открытоугольная глаукома, микроциркуляция сетчатки и диска зрительного нерва.*

Primary open-angle glaucoma (POAG) is a complex, multifactorial optic neuropathy characterized by progressive retinal ganglion cell (RGC) death and visual field loss. Elevated intraocular pressure (IOP) is a major risk factor, though not the sole cause. Effective management of POAG requires a comprehensive approach that encompasses pharmacological, surgical, and lifestyle interventions, as well as emerging scientific innovations.

Current Treatment Strategies

1. **Pharmacological Interventions**:

- **Prostaglandin Analogs**: These agents, including latanoprost, travoprost, and bimatoprost, enhance uveoscleral outflow by remodeling the extracellular matrix within the ciliary muscle and trabecular meshwork. They act on the prostaglandin F receptor (FP receptor), leading to increased matrix metalloproteinase expression.
- **Beta-Blockers**: Timolol and other beta-adrenergic antagonists reduce aqueous humor production by inhibiting cyclic AMP production in the ciliary epithelium. They are often used in conjunction with prostaglandin analogs for additive effects.
- **Alpha Agonists**: Agents like brimonidine reduce aqueous humor production and increase uveoscleral outflow. They activate alpha-2 adrenergic receptors, which in turn decrease adenylate cyclase activity.
- **Carbonic Anhydrase Inhibitors**: Dorzolamide and brinzolamide decrease aqueous humor secretion by inhibiting carbonic anhydrase in the ciliary processes, reducing bicarbonate ion formation and fluid transport.

2. **Laser Therapy**:

- **Selective Laser Trabeculoplasty (SLT)**: SLT uses a frequency-doubled Nd:YAG laser to target pigmented trabecular meshwork cells, inducing a biological response that increases aqueous outflow. The laser's energy is selectively absorbed by melanin-containing cells, minimizing collateral damage.

3. **Surgical Interventions**:

- **Trabeculectomy**: This procedure involves creating a fistula between the anterior chamber and the subconjunctival space, facilitating aqueous humor drainage. Antimetabolites like mitomycin-C are often used intraoperatively to prevent scarring.
- **Minimally Invasive Glaucoma Surgery (MIGS)**: Techniques such as the iStent, Hydrus Microstent, and Trabectome aim to enhance physiological outflow with minimal tissue disruption.

These devices are inserted into Schlemm's canal to bypass trabecular resistance.

Emerging Therapies and Technologies

1. **Neuroprotection**: Investigational neuroprotective strategies aim to preserve RGCs and optic nerve integrity. Agents like brimonidine have shown potential in reducing apoptosis through modulation of intracellular signaling pathways, including MAPK/ERK and PI3K/Akt.

2. **Gene Therapy**: The use of viral vectors, such as adeno-associated viruses (AAVs), to deliver therapeutic genes directly to ocular tissues is being explored. Modifying genes involved in aqueous humor dynamics or neuroprotection could provide long-term IOP control and RGC preservation.

3. **Implantable Devices**: Sustained-release platforms, such as biodegradable implants loaded with prostaglandins or other IOP-lowering agents, offer continuous drug delivery,

improving adherence and therapeutic outcomes. Examples include the Durysta (bimatoprost implant).

4. **Telemedicine and AI**: AI algorithms, particularly deep learning models, are being developed to analyze retinal images and OCT scans for early detection of glaucomatous changes.

Teleophthalmology facilitates remote monitoring and management, especially in underserved areas.

Lifestyle and Holistic Approaches

1. **Diet and Nutrition**: Nutritional interventions focus on antioxidants and neuroprotective nutrients. Omega-3 fatty acids, vitamins C and E, and zinc have been studied for their potential to support ocular health and reduce oxidative stress.

2. **Exercise**: Regular aerobic exercise has been shown to transiently reduce IOP and enhance ocular perfusion, potentially benefiting patients with glaucoma. Mechanisms may involve improved autonomic regulation and endothelial function.

3. **Patient Education and Support**: Comprehensive education programs empower patients by enhancing their understanding of glaucoma and its management, leading to improved adherence to treatment regimens and better clinical outcomes.

Conclusion

The comprehensive management of primary open-angle glaucoma is at the forefront of ophthalmic innovation, driven by advances in pharmacology, surgical techniques, and technology.

By integrating these novel approaches with lifestyle modifications and patient-centered care, clinicians can improve the prognosis and quality of life for individuals with this chronic condition. Continued research and interdisciplinary collaboration are essential for further enhancing our ability to combat this leading cause of irreversible blindness.

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