

WHY ADDRESSING GLAUCOMA IS INSUFFICIENT: OBSTACLES AND CONSTRAINTS IN VISION CONSERVATION

Mukhammadiyev Sobirjon Uchkunjon ugli

Assistant of Traumatology and Orthopedics Department, FMIOPH, Fergana, Uzbekistan

Eminov Ravshanjon Ikromjon Ugli

Assistant of Faculty and Hospital Surgery Department, FMIOPH, Fergana, Uzbekistan

Nishanov Eshonkhoja Khamedkhoja ugli

Assistant of Traumatology and Orthopedics Department, FMIOPH, Fergana, Uzbekistan

eshonxojanishonov@gmail.com

Abstract: Glaucoma, a significant optic neuropathy, is a principal contributor to irreversible blindness worldwide. Despite effective management of intraocular pressure (IOP), many patients continue to suffer vision loss due to factors beyond IOP. This review investigates the complex nature of glaucoma, encompassing vascular, neurodegenerative, and genetic elements, while also addressing the limitations of existing treatment modalities. Principal obstacles such as late diagnosis, adherence to therapy, and irreversible optic nerve damage, as well as systemic issues like healthcare inequities and socioeconomic influences, are scrutinized. Innovative approaches, including neuroprotective treatments, AI-enhanced diagnostics, personalized medicine, and vision rehabilitation, present potential improvements in patient outcomes. Nevertheless, considerable deficiencies in clinical implementation persist, requiring a fundamental shift in glaucoma management towards prioritizing vision conservation.

Keywords: glaucoma, vision preservation, neuroprotection, intraocular pressure, personalized medicine.

Introduction. Glaucoma is a neurodegenerative condition resulting in the loss of retinal ganglion cells and optic nerve degeneration, causing irreversible vision loss. Management primarily focuses on intraocular pressure control, the only modifiable risk factor shown to mitigate disease progression. Pharmacological options, like Rho kinase inhibitors, face challenges such as patient adherence and side effects. Surgical methods have shifted towards minimally invasive approaches that require further validation through extensive trials. Despite these developments, some patients experience vision loss even with controlled intraocular pressure, indicating additional factors in disease progression. This has sparked interest in neuroprotective strategies aimed at preserving retinal ganglion cells and optic nerve integrity independently of intraocular pressure management. Although animal studies show promise, no neuroprotective medications have received clinical approval. Future investigations are directed towards IOP-independent therapies, including gene and stem cell interventions, as well as personalized medical strategies to tackle glaucoma's intricate pathophysiology.

Understanding glaucoma beyond IOP. Intraocular pressure (IOP) is a pivotal modifiable risk factor in glaucoma treatment, targeting its reduction to avert optic nerve damage. However, disease progression persists in many patients despite adequate IOP management, suggesting additional contributing factors. Vascular parameters, including mean ocular perfusion pressure (MOPP) and blood pressure variability, notably influence normal tension glaucoma (NTG) progression. Research indicates that nocturnal blood pressure declines and MOPP fluctuations are associated with increased visual field impairment, implicating vascular dysregulation in the disease's advancement. Furthermore, glaucoma exhibits shared pathophysiological traits with neurodegenerative disorders such as Alzheimer's and Parkinson's, characterized by apoptosis, disrupted axonal transport, and oxidative stress, which IOP-lowering treatments do not address. Genetic factors also play a role in glaucoma risk, with specific genetic markers correlating with heightened vulnerability. The advancing comprehension of IOP necessitates extensive

monitoring, including ambulatory measurements, to identify fluctuations beyond office settings that correlate with disease progression independent of average IOP. This comprehensive perspective emphasizes the integration of vascular, neurodegenerative, and genetic factors into glaucoma management strategies to enhance patient outcomes beyond mere IOP control.

Challenges in vision preservation. Preserving vision in glaucoma patients is challenging due to the disease's asymptomatic nature leading to late diagnosis. Glaucoma, a progressive optic neuropathy, involves retinal ganglion cell loss and visual field deterioration, with elevated intraocular pressure as a significant modifiable risk factor. The asymptomatic progression complicates early detection, necessitating careful longitudinal monitoring to discern structural or functional changes. Current therapies target intraocular pressure management but often fail to prevent disease progression, as they do not address underlying optic nerve neurodegeneration. The irreversibility of optic nerve damage complicates treatment, as lost vision cannot be restored. Monitoring progression is difficult due to glaucoma's slow and variable nature, requiring clinical judgment to balance early intervention against overtreatment risks. Patient adherence to IOP-lowering therapies is low, often resulting in medication discontinuation and increased disease progression risk. The emotional and functional burden on patients is considerable, necessitating comprehensive self-management support that encompasses health information and daily living assistance. These challenges highlight the urgent need for improved diagnostic strategies, adherence support, and neuroprotective therapies to enhance vision preservation in glaucoma patients.

Year	Authors	Challenges	Impact On Vision Preservation
2022	Thomas V. Johnson, Adriana Di Polo, José-Alain Sahel, Joel S. Schuman	- Late diagnosis of neurodegenerative conditions affecting the retina and optic nerve poses a significant challenge, as it limits timely intervention and the potential for preserving vision in affected individuals.	- The key challenge faced in vision preservation despite effective glaucoma treatment is the presence of clinical barriers such as late diagnosis, gaps in health care access, and incomplete therapeutic responses to existing therapies.
2023	Shweta Tripathi, Kinjal Yogeshbhai Trivedi, Purvi R. Bhagat	- Medication adherence is a major issue in the management of glaucoma patients, with numerous obstacles identified in the literature that affect patients' compliance, including drug-related factors, patient-doctor interactions, and individual patient behaviors and lifestyles.	- Medication adherence is a major challenge in glaucoma management, as patients who do not take their medications as directed risk not achieving the expected treatment outcomes, which can lead to irreversible vision loss.
2023	Godswill I Nathaniel, Ukwu A. Eze	- The challenges related to surgeries and the preservation of the conjunctiva are influenced by the surgeon's skills and the choice of surgical site, which can vary across different procedures. Additionally, recommended alternative delivery systems for glaucoma management are often not readily available globally due to skill gaps,	- The long-term use of topical antiglaucoma medications, particularly those containing preservatives, can exacerbate ocular surface diseases, leading to chronic conjunctival inflammation and potentially compromising the success of glaucoma

ILM FAN YANGILIKLARI KONFERENSIYASI

MAY

ANDIJON, 2025

		and even when available, they may be inaccessible due to high costs and lack of insurance coverage in lower-income economies.	filtration surgeries, which are crucial for vision preservation.
2023	Yiting Hua, Hujie Lu, Jingyao Dai, Yewei Zhou, Wenzhe Zhou, Aisun Wang, Yanyan Chen, Youping Liang	- Patients with primary glaucoma face challenges in becoming experts in their condition, which involves understanding the complexities of glaucoma and its management, leading to feelings of inadequacy and frustration.	- Patients with primary glaucoma face challenges in becoming experts in managing their condition, which can impact their ability to preserve vision despite effective treatment.
2023		- Patients with primary glaucoma face challenges in becoming knowledgeable about their condition, including understanding the disease's characteristics and proper techniques for applying eye drops. Many patients reported a lack of prior knowledge about glaucoma, which hindered their ability to manage their health effectively.	- Patients with primary glaucoma face challenges such as managing negative emotions and adapting to daily life changes, which can hinder their ability to effectively engage in self-management and ultimately impact vision preservation despite treatment.
2023	s.y. h	- One of the significant challenges in diagnosing glaucoma is the considerable variation in the appearance of the optic disk and peripapillary region in normal eyes, which complicates the early detection of the disease. This variability can lead to difficulties in establishing a clear diagnosis, especially in patients with anomalous optic disks or other ocular characteristics such as high myopia.	- One of the key challenges in vision preservation despite effective glaucoma treatment is the difficulty in accurately diagnosing glaucoma in its early stages due to significant variations in the appearance of the optic disk and peripapillary region in normal eyes, which can lead to uncertainty in treatment decisions.
2023	Luciano Quaranta, Alessio Novella, Mauro Tettamanti, Luca Pasina, Robert N. Weinreb, Alessandro Nobili	- Many patients with glaucoma experience forgetfulness, which is reported as the primary reason for noncompliance with their medication regimen. This forgetfulness can be exacerbated by the complexity of the medication regimen, especially for those on multiple medications, making it difficult for patients to remember to take their eye drops consistently.	- Poor adherence to prescribed glaucoma therapy significantly hampers vision preservation, as it is closely related to disease progression and increased rates of visual field loss among patients.
2024	Marcelo Iran de Souza Coelho	- The patient experienced a steroid-induced elevation in intraocular pressure (IOP) following endoscopic cyclophotocoagulation (ECP) in the right eye, which complicated the management of his primary open-angle	- Despite effective glaucoma treatment, the patient experienced adverse reactions to medications, such as latanoprost, which led to complications like eye

		glaucoma (POAG). This necessitated the use of minimally invasive procedures to address the elevated IOP in the left eye.	swelling and discomfort, highlighting challenges in maintaining vision preservation during treatment.
2024	Siddharth Bhargava, Lauren Mason, Constance Okeke	- Challenges in implementing effective screening strategies for family members of glaucoma patients include slow disease progression, which can lead to delayed diagnosis and treatment, as well as healthcare accessibility issues that may prevent high-risk individuals from receiving timely screenings.	- The slow progression of glaucoma and the asymptomatic nature of the disease until late stages pose significant challenges to timely intervention and vision preservation, even with effective treatment options.
2024	Ghazi O. Bou Ghanem, Lauren K. Wareham, David J. Calkins	- The anatomical structure of the optic nerve head varies significantly between different species, such as rodents, nonhuman primates, and humans, which complicates the translation of preclinical findings to clinical applications in humans.	- Despite effective glaucoma treatments aimed at managing intraocular pressure, many patients continue to experience vision loss due to the neurodegeneration of retinal ganglion cells, highlighting the challenge of addressing the underlying disease mechanisms directly.

Table 1. Challenges in glaucoma management and vision preservation.

Emerging strategies and research directions. Emerging strategies in glaucoma management emphasize neuroprotection, diagnostic advancements, personalized medicine, and vision rehabilitation. Neuroprotective approaches are essential as conventional intraocular pressure reduction methods are insufficient for preventing retinal ganglion cell degeneration. Investigations into pharmacological agents like brimonidine and memantine, along with novel technologies such as stem cell and gene therapies, are underway to safeguard and regenerate retinal ganglion cells. In diagnostics, artificial intelligence significantly enhances glaucoma care through improved early detection and personalized treatment. AI algorithms demonstrate high precision in evaluating imaging techniques, facilitating early diagnosis and prognostic assessments. Furthermore, AI enhances teleophthalmology, broadening access to specialized care and enabling tailored treatment regimens. The incorporation of biomarkers, including genetic and metabolic indicators, presents a promising pathway for early diagnosis and monitoring of disease progression. Personalized medicine, propelled by AI and biomarker integration, seeks to customize interventions based on individual patient profiles, optimizing therapeutic efficacy and reducing adverse effects. Collectively, these advancements offer optimism for enhanced glaucoma management and vision restoration, although further investigation is required to substantiate these methods and incorporate them into clinical settings.

Barriers to vision preservation. Systemic challenges pertaining to the effective preservation of vision in glaucoma patients are intricate and multifaceted, involving a confluence of socioeconomic determinants, disparities in healthcare access, and constraints related to research funding and the clinical application of findings. The socioeconomic status of individuals plays a crucial role in determining access to glaucoma-related care, as elements such as insurance eligibility, educational attainment, income levels, and marital circumstances significantly affect

both diagnosis and adherence to prescribed treatment regimens. Furthermore, these socioeconomic variables are intensified by racial inequities, with empirical studies revealing that African American patients and those residing in economically disadvantaged areas are disproportionately impacted by more severe manifestations of glaucoma. Healthcare inequalities are further aggravated by systemic obstacles to accessing necessary medications, as a notable proportion of glaucoma prescriptions generated electronically are not fulfilled due to complications such as prior authorization requirements and limitations in insurance coverage. Moreover, the prevailing lack of awareness and education surrounding glaucoma, particularly within underserved populations, contributes to delays in diagnosis and treatment initiation, thereby exacerbating the overall progression of the disease. In spite of the advancements made in diagnostic and therapeutic technologies, these disparities remain entrenched, underscoring the urgent need for targeted interventions, including teleophthalmology and the application of artificial intelligence, to enhance early detection and management practices. Effectively addressing these systemic challenges necessitates a concerted collaboration among healthcare practitioners, policymakers, and researchers to formulate strategies that not only enhance access to care but also improve patient education and ensure an equitable distribution of healthcare resources.

Conclusion. The management of glaucoma has evolved considerably, especially in the regulation of intraocular pressure. Nonetheless, the ongoing visual impairment encountered by numerous patients underscores the necessity to consider determinants that extend beyond intraocular pressure. Multifaceted factors such as vascular dysregulation, neurodegeneration, and genetic susceptibility are instrumental in the advancement of the disease, while systemic obstacles and the limitations of therapeutic interventions exacerbate the difficulties associated with vision preservation. Future investigative efforts should prioritize neuroprotective and regenerative methodologies, precision diagnostic techniques, and the implementation of personalized medicine. Furthermore, tackling healthcare disparities and enhancing patient education are imperative for ensuring equitable access to efficacious treatment. An all-encompassing strategy that amalgamates these approaches will be crucial in bridging the divide between therapeutic interventions and sustained vision conservation.

References:

1. Abjalilovna, M. S. (2024). GIPOKSIYA VA GIPOKSIYAGA MOSLASHUV MEXANIZMLARI. THE THEORY OF RECENT SCIENTIFIC RESEARCH IN THE FIELD OF PEDAGOGY, 2(21), 329-332.
2. Alpersovna, M. Y., & Erkinjon o'g'li, L. A. (2025). ALKOGOLLI PANKREATIT: SABABLARI, BELGILARI VA DAVOLASH USULLARI. ZAMONAVIY TA'LIMDA FAN VA INNOVATSION TADQIQOTLAR JURNALI, 3(2), 17-22.
3. Gochadze, A. L., & Irgasheva, M. D. (2016). Using clinical interactive games on lessons in medical colleges. Актуальные проблемы гуманитарных и естественных наук, (5-6), 26-28.
4. Ravshan o'g'li, K. S., & Mavlonjon o'g'li, Q. J. (2024). Review Of The Use Of Tomosynthesis For The Diagnosis Of Injuries And Diseases Of The Musculoskeletal System. Frontiers in Health Informatics, 13(6).
5. Sadriddin, P., Akhtam, R., Mahbuba, A., Sherzod, K., Gulnora, R., Orif, N., ... & Dilshod, D. (2025). Dual-Ligand Liposomes Nano carrier with Cisplatin and Anti-PD-L1 siRNA in Head and Neck Squamous Cell Carcinoma: A Review. Journal of Nanostructures, 15(1), 292-300.
6. USING PRP IN THE TREATMENT OF ORTHOPEDIC DISEASES. (2025). International Journal of Medical Sciences, 5(05), 209-211. <https://doi.org/10.55640/>
7. Xamedxuja o'g'li, N. E. (2023). Pathogenetic Mechanisms of the Development of Severe Functional Disorders in Injuries of the Calf-Acorn Joint. SCIENTIFIC JOURNAL OF

APPLIED AND MEDICAL SCIENCES, 2(11), 427–429. Retrieved from <https://sciencebox.uz/index.php/amaltibbiyot/article/view/8628>

8. Xamedxuja o'g'li, N. E. IMPROVEMENT OF TREATMENT METHODS FOR CALF-ASIK JOINT INJURIES.

9. Иргашева, М. (2025). Симуляция в клиническом сестринском образовании. Общество и инновации, 6(2/S), 107-112.

10. Латибжонов, А., & Умарова, С. (2023). Технологии искусственного интеллекта в медицине. in Library, 1(1).

11. Мирзажоннова, С. А., Расулова, М. Т., & Ганижонов, П. Х. ИЗМЕНЕНИЯ ПРОЦЕССА ГИПОКСИИ ОРГАНИЗМА ПРИ ГЕМИЧЕСКОЙ АНЕМИИ.

12. Мусаева, Ю. А. (2025). АЛКОГОЛЛИ ПАНКРЕАТИТДА ЛИМФА ТУГУНЛАРИНИНГ ГИСТОКИМЁВИЙ ЎЗГАРИШЛАРИ. MODERN EDUCATIONAL SYSTEM AND INNOVATIVE TEACHING SOLUTIONS, 1(7), 29-31.

13. Туйчибеков, Ш. (2023). Риск смертности при применении НПВС у детей. in Library, 1(1), 67-71.

14. Туйчибеков, Ш., & Нишонов, Е. (2024). Морфологические основы практических рекомендаций по конфокальным морфометрическим показателям повреждений хвоста. in Library, 2(2), 14-17.

15. Тўхтаев, Ж. Т., Ботиров, Н. Т., & Нишонов, Э. Х. (2023). Болдир-ошиқ бўғими шикастланишларини ташхислаш ва даволаш. Zamonaviy tibbiyot jurnali (Журнал современной медицины), 1(1), 27-39.

16. Хомидчонова, Ш. Х., & Мирзажоннова, С. А. (2023). Основные Методы Определения Состава Тела. Miasto Przyszłości, 36, 181-185.