# GLAUCOMA: CURRENT APPROACHES TO EARLY DIAGNOSIS AND MANAGEMENT

Xamrayeva Fazila Xashimovna
Master in Information Technologies in Education, Bukhara Innovation Institute
Mubinova Jasmina Jamshidovna
3rd-year student of the "Pediatrics" program, Bukhara State Medical Institute
Yarasheva Marjona Oripovna
3rd-year student of the "Pediatrics" program, Bukhara State Medical Institute

DOI: https://doi.org/10.5281/zenodo.24299586 · Received: 11 November 2026 · Accepted: 14 November 2026 · Published: 17 November 2026

**Abstract:** This article reviews current approaches to the early diagnosis and management of glaucoma, a chronic progressive optic neuropathy and one of the leading causes of irreversible blindness worldwide. The epidemiology, pathophysiology, risk factors and main clinical forms of the disease are described. Particular attention is paid to modern diagnostic methods, including tonometry, gonioscopy, perimetry and optical coherence tomography, as well as to medical, laser and surgical treatment strategies. The importance of timely detection and long-term patient adherence to therapy is emphasized.

**Keywords:** glaucoma, intraocular pressure, optic neuropathy, early diagnosis, optical coherence tomography, visual field, treatment

## Introduction

Vision is the main channel through which a person receives information about the surrounding world, and its loss significantly reduces independence and quality of life. Among eye diseases, glaucoma occupies a special place because it often develops without pain or noticeable symptoms, and the patient becomes aware of the problem only when a considerable part of the visual field has already been lost. For this reason glaucoma is frequently called the "silent thief of sight."

According to epidemiological modelling, about 64 million people aged 40–80 years were living with glaucoma in 2013, and this number is expected to reach approximately 112 million by 2040 as populations age [1]. Unlike cataract, whose visual consequences can be reversed by surgery, the damage caused by glaucoma is irreversible. Therefore, the main goals of modern ophthalmology are to detect the disease as early as possible and to prevent its progression. This work reviews current approaches to the early diagnosis and management of glaucoma.

## MAIN PART

### Definition and pathophysiology

Glaucoma is a group of chronic optic neuropathies characterized by progressive loss of retinal ganglion cells and their axons, structural changes of the optic nerve head and corresponding defects of the visual field [2]. The most important and the only modifiable risk factor is elevated intraocular pressure (IOP). The aqueous humour is continuously produced by the ciliary body and drains from the eye mainly through the trabecular meshwork in the anterior chamber angle. When outflow is impaired, IOP rises and the optic nerve fibres are damaged mechanically and through disturbed blood supply. The statistical upper limit of normal IOP is usually taken as 21 mmHg, but individual susceptibility varies widely: some patients develop damage at "normal" pressure (normal-tension glaucoma), while others with elevated pressure may never develop optic neuropathy [2, 3].

### Types of glaucoma

Glaucoma is classified according to the anatomy of the anterior chamber angle and the cause of the disease. The main forms are the following:

1. Primary open-angle glaucoma (POAG) is the most common form. The angle is open, but resistance to aqueous outflow gradually increases. The course is slow and asymptomatic; peripheral vision is affected first, while central vision remains intact until late stages.

2. Primary angle-closure glaucoma (PACG) develops when the iris blocks the drainage angle. It may be chronic or present as an acute attack with severe eye pain, headache, nausea, halos around lights and sudden loss of vision, which is an ophthalmic emergency.

3. Normal-tension glaucoma is characterized by typical optic nerve damage despite IOP within the statistically normal range.

4. Secondary and congenital glaucoma arise as a result of other conditions (trauma, uveitis, neovascularization in diabetes, long-term corticosteroid use) or because of developmental anomalies of the angle present from birth [3].

### Risk factors

The risk of glaucoma increases with age, particularly after 40 years. A positive family history is among the strongest predictors: first-degree relatives of affected patients have a markedly higher risk than the general population. Other recognized factors include elevated IOP, high myopia, thin central corneal thickness, previous ocular trauma, diabetes mellitus, arterial hypertension and prolonged use of corticosteroids. In addition, the prevalence and severity of some forms differ between ethnic groups; for example, angle-closure glaucoma is more common in East Asian populations, whereas POAG is more frequent and often more aggressive in people of African descent [1, 4].

### Early diagnosis

Glaucoma is asymptomatic in its early stage, and a single examination is not sufficient for diagnosis. Current guidelines recommend a combination of tests that assess both

© 2026 Bulletin of International Journals · Germany · ISSN 2750-3399 · CC BY 4.0

the structure and the function of the optic nerve [5, 6]. A comprehensive examination usually includes:

1. Tonometry – measurement of IOP, most often with Goldmann applanation tonometry, which is considered the reference method. Single measurements may be normal, so repeated measurements at different times of day are valuable.

2. Gonioscopy – direct examination of the anterior chamber angle, which allows open-angle and angle-closure forms to be distinguished.

3. Ophthalmoscopy and fundus photography – evaluation of the optic nerve head, including the cup-to-disc ratio, rim thinning, notching and disc haemorrhages.

4. Standard automated perimetry – assessment of the visual field. Characteristic arcuate and nasal-step defects reflect damage to nerve fibre bundles; however, a substantial number of ganglion cells may already be lost before defects become detectable.

5. Optical coherence tomography (OCT) – a non-invasive imaging method that measures the thickness of the retinal nerve fibre layer and ganglion cell complex. OCT can reveal structural damage before visual field changes appear and is widely used to monitor progression [2, 5].

6. Pachymetry – measurement of central corneal thickness, which is necessary for the correct interpretation of IOP values.

Promising directions include OCT angiography, home and continuous IOP monitoring, and artificial-intelligence algorithms for analysis of fundus photographs and OCT scans, which may improve screening in primary care; nevertheless, their routine clinical use still requires further validation. Because about half of all patients with glaucoma are unaware of their disease [1, 4], regular eye examinations for people over 40 and for those with risk factors remain the most effective strategy for early detection.

## Current management

Lost vision cannot be restored, so the aim of treatment is to lower IOP to a level at which the optic nerve is no longer damaged, thus preserving vision and quality of life for the patient's lifetime. Large randomized trials have provided strong evidence for this approach. The Ocular Hypertension Treatment Study showed that topical IOP-lowering therapy substantially reduced the incidence of glaucoma in patients with ocular hypertension [7], the Early Manifest Glaucoma Trial demonstrated that each millimetre of mercury of IOP reduction lowers the risk of progression [8], and the UK Glaucoma Treatment Study confirmed that a prostaglandin analogue slowed visual field loss compared with placebo [9]. The target IOP is individualized according to the stage of disease, the rate of progression, age and life expectancy.

Medical therapy. Treatment usually starts with topical medications. Prostaglandin analogues are most often used as first-line agents because they are effective and need to be instilled only once a day. Beta-blockers, carbonic anhydrase inhibitors and alpha-2 agonists reduce aqueous production, and combinations of drugs are used when monotherapy is insufficient [5, 6]. A major problem is poor adherence, since patients without symptoms may not see the need to continue treatment; education, simplified regimens and regular follow-up are therefore essential.

Laser treatment. Selective laser trabeculoplasty improves aqueous outflow in open-angle glaucoma and is now accepted as a first-line alternative to drops in selected patients. Laser peripheral iridotomy creates an additional pathway for aqueous humour in angle-closure disease and helps prevent acute attacks [5, 6].

Surgical treatment. When medications and laser fail to achieve the target pressure, filtering surgery (trabeculectomy), drainage implants or minimally invasive glaucoma surgery (MIGS) may be performed. Surgery creates a new outflow pathway and is chosen according to the type and severity of glaucoma. Patients remain under lifelong observation after any intervention.

## Prevention and patient education

There is no guaranteed way to prevent glaucoma, but outcomes depend largely on early detection. Patients should be informed about the chronic nature of the disease, the need to use prescribed drops regularly and the importance of follow-up examinations. Relatives of patients should undergo screening. Medications such as corticosteroids should be used under medical supervision, and protective eyewear should be worn to avoid ocular injuries. Healthy lifestyle measures, including control of diabetes and blood pressure, contribute to general vascular health, but they do not replace specific treatment [4].

## Conclusion

Glaucoma is a chronic progressive optic neuropathy that can lead to irreversible blindness if it is diagnosed late. Its early stages are usually asymptomatic, so detection depends on systematic examination that combines IOP measurement, gonioscopy, evaluation of the optic nerve head, perimetry and OCT. Modern treatment, which includes topical medications, laser procedures and surgery, can effectively lower IOP and slow disease progression, but it cannot restore lost vision. Therefore, regular preventive eye examinations for people over 40 and for those with a family history or other risk factors, together with patient education and good adherence to therapy, are the key measures for preserving vision. Further development of screening technologies and new neuroprotective strategies may improve the outlook for patients in the future.

## References

[1] Tham, Y. C., Li, X., Wong, T. Y., Quigley, H. A., Aung, T., & Cheng, C. Y. (2014). Global prevalence of glaucoma and projections of glaucoma burden through 2040: A systematic review and meta-analysis. Ophthalmology, 121(11), 2081–2090.

[2] Weinreb, R. N., Aung, T., & Medeiros, F. A. (2014). The pathophysiology and treatment of glaucoma: A review. JAMA, 311(18), 1901–1911.

[3] Jonas, J. B., Aung, T., Bourne, R. R., Bron, A. M., Ritch, R., & Panda-Jonas, S. (2017). Glaucoma. The Lancet, 390(10108), 2183–2193.

[4] Stein, J. D., Khawaja, A. P., & Weizer, J. S. (2021). Glaucoma in adults: Screening, diagnosis, and management. A review. JAMA, 325(2), 164–174.

[5] European Glaucoma Society. (2021). Terminology and guidelines for glaucoma (5th ed.). British Journal of Ophthalmology, 105(Suppl 1), 1–169.

© 2026 Bulletin of International Journals · Germany · ISSN 2750-3399 · CC BY 4.0

[6] American Academy of Ophthalmology. (2021). Primary Open-Angle Glaucoma Preferred Practice Pattern. San Francisco, CA: AAO.

[7] Kass, M. A., Heuer, D. K., Higginbotham, E. J., et al. (2002). The Ocular Hypertension Treatment Study: A randomized trial determines that topical ocular hypotensive medication delays or prevents the onset of primary open-angle glaucoma. Archives of Ophthalmology, 120(6), 701–713.

[8] Heijl, A., Leske, M. C., Bengtsson, B., et al. (2002). Reduction of intraocular pressure and glaucoma progression: Results from the Early Manifest Glaucoma Trial. Archives of Ophthalmology, 120(10), 1268–1279.

[9] Garway-Heath, D. F., Crabb, D. P., Bunce, C., et al. (2015). Latanoprost for open-angle glaucoma (UKGTS): A randomised, multicentre, placebo-controlled trial. The Lancet, 385(9975), 1295–1304.

[10] World Health Organization. (2019). World report on vision. Geneva: WHO.

© 2026 Bulletin of International Journals · Germany · ISSN 2750-3399 · CC BY 4.0