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Glaucoma: Types, Risk Factors, Detection, and Management

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Abstract **Review Article**

Glaucoma is a complicated set of optic neuropathies that is defined by a gradual loss of retinal ganglion cells (RGCs), as well as visual field abnormalities that correlate to this loss. Glaucoma is the leading cause of irreversible blindness in the world. Glaucoma is the most common cause of blindness that cannot be reversed around the world. The primary purpose of this investigation was to conduct a review study on glaucoma from a variety of aspects, including its description, forms, and management, as well as the importance of routine eye examinations. Glaucoma refers to a set of eye illnesses that, when taken together, have the potential to cause irreversible damage to a person's vision if the disease is not properly recognized and treated in a timely way. It is possible for a person's eyesight to become impaired due to glaucoma if the disease is not detected and treated in a timely manner. Glaucoma can be subdivided into a number of different major subtypes, the most common of which are primary open-angle glaucoma, angle-closure glaucoma, normal- tension glaucoma, and secondary glaucoma. Glaucoma can be caused by a number of factors in addition to variables such as a rise in intraocular pressure. These variables include the patient's age, the medical history of the patient's family, the patient's ethnicity, and certain medical illnesses.

Keywords: Glaucoma, types of glaucoma, risk factors, optic nerve, secondary glaucoma.

INTRODUCTION

Glaucoma is a complex group of optic neuropathies that is characterized by a slow loss of retinal ganglion cells (RGCs), as well as visual field defects that correlate to this loss. Glaucoma is the leading cause of irreversible blindness in the world (Crabb *et al.*, 2013). Glaucoma is commonly referred to as "the silent thief of sight" since patients typically do not feel any symptoms in the early stages of the disease. It is why the disease has earned its nickname. Glaucoma results in a progressive loss of peripheral and mid-peripheral vision; however, the patient is not aware of this loss because the visual cortex "fills in" the missing portions of the vision (Zhang *et al.*, 2017). Glaucoma causes a slow loss of vision in the centre of the field of view as well as in the periphery. This results in delays in the diagnosis and treatment, and it is likely that the glaucoma may not be diagnosed until the disease has progressed to a moderate or severe level, at which point significant vision loss will have already taken place. At this stage, a person may perceive an increased risk of falling and running into things when walking, in addition to experiencing difficulty operating a motor vehicle (Lee and Mackey, 2022). These experiences, in the long run, have the impact of diminishing a person's confidence and independence, which ultimately leads to a reduction in mobility and a reduced frequency of leaving the house (Zhao *et al.*, 2015). It is inevitable that being unable to participate in particular pursuits will have an effect on one's quality of life (Tham *et al.*, 2014). This is demonstrated by the high incidence of clinical depression and anxiety (Doshi *et al.*, 2008; Leske *et al.*, 2008), as well as the cognitive deficiencies that are observed in people who have glaucoma (Sanfilippo *et al.*, 2010).

Glaucoma is the collective name for a group of eye diseases that are characterized by progressive damage to the optic nerve (Lee and Mackey, 2022). This damage results in a reduction in one's ability to see, and if the condition is not treated, it has the potential to progress to total blindness (Medical Advisory Secretariat, 2006). It is one of the most important factors that leads to permanent blindness in people all over the world. This study provides an overview of glaucoma, including the various subtypes of the illness, risk factors, diagnosis methods, and therapeutic strategies.

Types of Glaucoma

The most common kind of glaucoma is called primary open-angle glaucoma (POAG), and it's estimated that between 70 and 90 percent of all cases are

caused by it (Sihota *et al.,* 2018). Laser surgery is an option for those suffering from this form of glaucoma (Sihota *et al.,* 2017). Because it is a slow process, it is often not discovered until after significant vision loss has already taken place (Krishnamurthy *et al.,* 2022). Elevated intraocular pressure is virtually always present in patients who have POAG. This pressure is brought on by an obstruction in the drainage system of the eye, which occurs when POAG is present (Yang *et al.,* 2016).

Glaucoma with an angle closure, also known as angle-closure glaucoma (ACG), is characterized by a sudden increase in intraocular pressure that occurs when the iris of the eye completely blocks the drainage angle. This specific type of glaucoma commonly presents itself with substantial symptoms, some of which include discomfort in the eyes, headaches, blurred vision, and nausea. It is absolutely necessary that you get medical attention as soon as possible (Lim *et al.,* 2017).

Glaucoma with normal tension, sometimes referred to as NTG, is a type of glaucoma that causes damage to the optic nerve while having normal intraocular pressure (Kim *et al.,* 2019). This type of glaucoma is often referred to as "normal tension glaucoma." Researchers believe that neovascular age-related macular degeneration (NTG) may be tied to vascular factors or an individual's vulnerability to optic nerve damage. However, the exact cause of NTG is not yet identified (Leung *et al.,* 2022).

Secondary glaucoma is a form of the disease that develops after another eye condition, such as uveitis, trauma, diabetes, or the use of certain medicines, has previously been present in the patient's body (Senthil *et al.,* 2021). This type of glaucoma is known as secondary angle-closure glaucoma. In order for treatment for secondary glaucoma to be effective, it is necessary to focus on the underlying source of the condition (Greslechner and Helbig, 2022).

Risk Factors Leading to Glaucoma

Glaucoma can strike anyone at any age; however, there are a number of risk factors that dramatically increase one's likelihood of developing the disease (Lee and Mackey, 2022).

Increased intraocular pressure: The condition known as increased intraocular pressure is the single most important risk factor associated with the development of glaucoma. Glaucoma can develop in persons whose intraocular pressure is either normal or low, in addition to people whose intraocular pressure is either high or normal. Glaucoma, on the other hand, is impossible to develop in people whose intraocular pressure is normal (Zhang *et al.,* 2020).

Glaucoma is a condition that has a higher risk of developing as a person reaches older ages, particularly after the age of 60. Those who have already reached that age are at an increased risk (Shah *et al.,* 2022).

People who come from families in whom glaucoma has been identified in prior decades have a larger chance of developing the ailment themselves if they inherit the genetic predisposition (Weinreb *et al.,* 2014).

Ethnicity: People of specific racial and ethnic backgrounds, such as African Americans, Hispanics, and Asians, have a higher incidence of glaucoma and are at an enhanced risk for having the disease. This is due to the fact that people of these backgrounds are more likely to have a family history of the condition (Gupta ad Chen, 2016; Jonas *et al.,* 2017).

Other health-related issues: People who already have diabetes (Kim and Kang, 2017), high blood pressure (Moore) *et al.,* 2017, or myopia (nearsightedness) (Bae *et al.,* 2017) are at a greater risk of developing glaucoma later in life than those who do not have any of these previous illnesses.

The Identification and Examination of the Ailment

It is critical to detect glaucoma in its earlier stages and to keep up with routine appointments for eye exams (Foster *et al.,* 2002). The following diagnostic tests are some of the most often used:

An instrument called a tonometer is utilized in the process of tonometry, which is a test that is performed to determine the pressure that is present within the eye. Having a high intraocular pressure, on the other hand, is a considerable risk factor for developing glaucoma and is not to be overlooked as a result (Keeler *et al.,* 2014; Albert ad Keeler, 2020).

In this test, the patient's entire field of vision is measured, and the examiner looks for any subtle alterations or loss in vision that might be an indication of glaucoma (Brusini *et al.,* 2021).

OCT stands for optical coherence tomography and is a non-invasive imaging technology that provides high- resolution cross-sectional images of the optic nerve and retina. Because of this, an early detection of the structural anomalies that are associated with glaucoma is now achievable (Wang *et al.,* 2021).

Management of Glaucoma

Early detection and treatment of glaucoma can protect a patient's vision and slow down the disease's progression, despite the fact that glaucoma currently has no known medication that can reverse the condition (Mohan *et al.,* 2021).

Management Tactics Include:

Eye drops: Medications that are supplied in the form of eye drops are usually given with the intention of reducing the amount of pressure that is present within the

eye. This is typically done in order to alleviate symptoms associated with ocular hypertension. There is a possibility that some of these will include carbonic anhydrase inhibitors, beta-blockers, alpha-agonists, and prostaglandin analogues (Brandt *et al.*, 2017; Xu *et al.*, 2019).

In order to either increase drainage or reduce intraocular pressure, laser therapy can be performed in the form of selective laser trabeculoplasty (SLT) or laser peripheral iridotomy (LPI), respectively. Both of these procedures are performed on the eye (Pescosolido *et al.*, 2011).

In cases where conventional medical treatment and laser therapy are not sufficient to alleviate the symptoms of the ailment, surgical procedures could be recommended as an additional mode of treatment (Honjo *et al.*, 2007; Mohan *et al.*, 2022). Therapies that can be undertaken to promote drainage of fluid away from the eye include surgical treatments such as trabeculotomy, and tube shunt surgery (Tanna and Johnson, 2018).

Adjustments to one's way of life: Glaucoma care frequently entails making modifications to one's way of life. These include keeping a healthy weight, not smoking, engaging in regular physical activity, and effectively treating other medical conditions such as diabetes and high blood pressure (Bhartiya and Ichhpujani, 2014).

Glaucoma is a chronic condition that needs to be handled continually throughout one's life, so it is important to have regular follow-up appointments. It is essential to schedule routine appointments with an ophthalmologist in order to monitor the evolution of the problem, determine whether any necessary adjustments to the treatment are necessary, and prevent further vision loss (Virno *et al.*, 2000; Moumneh *et al.*, 2020; Mohan *et al.*, 2022).

SUMMARY

Glaucoma is a group of eye diseases that, if not properly diagnosed and treated in a timely manner, can cause irreparable damage to a person's eyesight. If glaucoma is not discovered and treated in a timely manner, the damage to a person's vision can occur. Glaucoma can be broken down into several major subtypes, the most frequent of which are primary open-angle glaucoma, angle-closure glaucoma, normal-tension glaucoma, and secondary glaucoma. In addition to variables such as an increase in intraocular pressure, the development of glaucoma can also be influenced by factors such as age, the medical history of the patient's family, the patient's ethnicity, and specific medical diseases. This is the case despite the fact that an elevated intraocular pressure is a major contributor to the risk. Thorough eye examinations, which may include tonometry, visual field testing, and optical coherence tomography (OCT), are necessary for early detection, which is critical for quick intervention. Early detection can be performed with thorough eye examinations. Eyedrops, laser therapy, and surgical procedures are just some of the treatment choices that may be deployed in order to reduce the patient's intraocular pressure down to a level that is more bearable. Other treatment options include antibiotics, anti-inflammatory drugs, and anti-inflammatory steroids. Alterations to one's way of living as well as the maintenance of a regular appointment schedule for routine checkups and follow-ups are other necessary components of glaucoma treatment.

It is imperative to consult an ophthalmologist in the event that you have any concerns regarding the health of your eyes or if you believe that you may be at risk for glaucoma. This will allow you to receive an accurate assessment as well as suitable guidance. Bear in mind that with early detection and the appropriate treatment of their illness, people who have glaucoma can have a large amount of their vision retained, and their quality of life can significantly improve.

REFERENCES

- Albert, D. M., & Keeler, R. (2020). The Pressure: Before and after Schiøtz. Ophthalmology. *Glaucoma*, *3*(6), 409–413. https://doi.org/10.1016/j.ogla.2020.04.015
- Bae, H. W., Seo, S. J., Lee, S. Y., Lee, Y. H., Hong, S., Seong, G. J., & Kim, C. Y. (2017). Risk factors for visual field progression of normal-tension glaucoma in patients with myopia. Canadian journal of ophthalmology. *Journal canadien d'ophtalmologie*, *52*(1), 107–113. https://doi.org/10.1016/j.jcjo.2016.08.011
- Bhartiya, S., & Ichhpujani, P. (2014). Complementary and alternate management of glaucoma: The verdict so far. *J Curr Glaucoma Pract*, *8*, 54–7. [PMC free article] [PubMed] [Google Scholar].
- Brandt, J. D., DuBiner, H. B., Benza, R., Sall, K. N., Walker, G. A., Semba, C. P., ... & Wirta, D. (2017). Long-term safety and efficacy of a sustained-release bimatoprost ocular ring. *Ophthalmology*, *124*(10), 1565-1566. [PubMed] [Google Scholar]
- Brusini, P., Salvetat, M. L., & Zeppieri, M. (2021). How to Measure Intraocular Pressure: An Updated Review of Various Tonometers. *Journal of clinical medicine*, *10*(17), 3860. https://doi.org/10.3390/jcm10173860.
- Crabb, D. P., Smith, N. D., Glen, F. C., Burton, R., & Garway-Heath, D. F. (2013). How does glaucoma look?: patient perception of visual field loss. *Ophthalmology*, *120*(6), 1120-1126. https://doi.org/10.1016/j.ophtha.2012.11.043.
- Doshi, V., Ying-Lai, M., Azen, S. P., Varma, R., & Los Angeles Latino Eye Study Group (2008). Sociodemographic, family history, and lifestyle risk factors for open-angle glaucoma and ocular hypertension. The Los Angeles Latino Eye Study.

Ophthalmology, *115*(4), 639–647.e2. https://doi.org/10.1016/j.ophtha.2007.05.032.

- Foster, P. J., Buhrmann, R., Quigley, H. A., & Johnson, G. J. (2002). The definition and classification of glaucoma in prevalence surveys. *The British journal of ophthalmology*, *86*(2), 238–242. https://doi.org/10.1136/bjo.86.2.238
- Greslechner, R., & Helbig, H. (2022). Secondary Glaucoma in the Context of Retinal Disease. Sekundärglaukome im Rahmen retinaler Erkrankungen. *Klinische Monatsblatter fur Augenheilkunde*, *239*(9), 1111–1118. https://doi.org/10.1055/a-1797-5188.
- Gupta, D., & Chen, P. P. (2016). Glaucoma. *American family physician*, *93*(8), 668–674.
- Honjo, M., Tanihara, H., Kameda, T., Kawaji, T., Yoshimura, N., & Araie, M. (2007). Potential role of Rho-associated protein kinase inhibitor Y-27632 in glaucoma filtration surgery. *Investigative ophthalmology & visual science*, *48*(12), 5549–5557. https://doi.org/10.1167/iovs.07-0878.
- Jonas, J. B., Aung, T., Bourne, R. R., Bron, A. M., Ritch, R., & Panda-Jonas, S. (2017). Glaucoma. *Lancet (London, England)*, *390*(10108), 2183–2193. https://doi.org/10.1016/S0140-6736(17)31469-1
- Keeler, C. R., Helland, M., & Albert, D. M. (2014). Hjalmar Schiøtz, the great Norwegian innovator and his ophthalmoscope. *Acta ophthalmologica*, *92*(6), 588–592. https://doi.org/10.1111/aos.12274.
- Kim, S. W., & Kang, G. W. (2017). Diabetes mellitus as a risk factor for glaucoma outcome in Korea. *Acta ophthalmologica*, *95*(7), e662–e664. https://doi.org/10.1111/aos.13345
- Kim, W. J., Kim, J. M., Kim, K. N., & Kim, C. S. (2019). Effect of Preoperative Factor on Intraocular Pressure after Phacoemulsification in Primary Open-angle Glaucoma and Primary Angle-closure Glaucoma. *Korean journal of ophthalmology: KJO*, *33*(4), 303–314. https://doi.org/10.3341/kjo.2018.0135.
- Krishnamurthy, R., Senthil, S., Rao, H. L., Mandal, A. K., & Garudadri, C. (2022). Outcomes of trabeculectomy in eyes with refractory acute primary angle-closure in Indian eyes. *Indian journal of ophthalmology*, *70*(2), 580–584. https://doi.org/10.4103/ijo.IJO_1065_21.
- Lee, S. S., & Mackey, D. A. (2022). Glaucoma - risk factors and current challenges in the diagnosis of a leading cause of visual impairment. *Maturitas*, *163*, 15–22. https://doi.org/10.1016/j.maturitas.2022.05.002.
- Leske, M. C., Wu, S. Y., Hennis, A., Honkanen, R., Nemesure, B., & BESs Study Group (2008). Risk factors for incident open-angle glaucoma: the Barbados Eye Studies. *Ophthalmology*, *115*(1), 85–93. https://doi.org/10.1016/j.ophtha.2007.03.017.
- Leung, D. Y. L., & Tham, C. C. (2022). Normal-tension glaucoma: Current concepts and approaches-A review. *Clinical & experimental ophthalmology*, *50*(2), 247–259. https://doi.org/10.1111/ceo.14043.
- Lim, D., Aquino, M. C., & Chew, P. (2017). Surgical Treatment of Angle-Closure Glaucoma. *Developments in ophthalmology*, *59*, 147–154. https://doi.org/10.1159/000458493.
- Liu, S., Kang, M., Hussain, I., Li, K., Yao, F., & Fu, G. (2016). High mechanical strength and stability of alginate hydrogel induced by neodymium ions coordination. *Polymer Degradation and Stability*, *133*, 1-7.
- Medical Advisory Secretariat. (2006). Routine eye examinations for persons 20-64 years of age: an evidence-based analysis. *Ontario health technology assessment series*, *6(*15), 1–81.
- Mohan, N., Chakrabarti, A., Nazm, N., Mehta, R., & Edward, D. P. (2022). Newer advances in medical management of glaucoma. *Indian journal of ophthalmology*, *70*(6), 1920–1930. https://doi.org/10.4103/ijo.IJO_2239_21.
- Moore, N. A., Harris, A., Wentz, S., Vercellin, A. C. V., Parekh, P., Gross, J., ... & Siesky, B. (2017). Baseline retrobulbar blood flow is associated with both functional and structural glaucomatous progression after 4 years. *British Journal of Ophthalmology*, *101*(3), 305-308.
- Moumneh, K., Sheybani, A., Fellman, R. L., Godfrey, D. G., & Grover, D. S. (2020). Reticular Corneal Edema or Corneal Honeycombing in Eyes Treated With Netarsudil: A Case Series. *Journal of glaucoma*, *29*(7), 607–610. https://doi.org/10.1097/IJG.0000000000001516.
- Pescosolido, N., Librando, A., Puzzono, M., & Nebbioso, M. (2022). Palmitoylethanolamide effects on intraocular pressure after Nd:YAG laser iridotomy:An experimental clinical study. *J Ocul Pharmacol Ther*, *27*, 629–35. [PubMed] [Google Scholar].
- Sanfilippo, P. G., Hewitt, A. W., Hammond, C. J., & Mackey, D. A. (2010). The heritability of ocular traits. *Survey of ophthalmology*, *55*(6), 561–583. https://doi.org/10.1016/j.survophthal.2010.07.003
- Senthil, S., Dada, T., Das, T., Kaushik, S., Puthuran, G. V., Philip, R., Rani, P. K., Rao, H., Singla, S., & Vijaya, L. (2021). Neovascular glaucoma - A review. *Indian journal of ophthalmology*, *69*(3), 525–534. https://doi.org/10.4103/ijo.IJO_1591_20
- Shah, S. M., Boopathiraj, N., Starr, M. R., Dalvin, L. A., AbouChehade, J., Damento, G., ... & Iezzi, R. (2022). Risk, Prevalence, and Progression of Glaucoma in Eyes With Age-Related Macular Degeneration Treated With Intravitreal Anti–Vascular Endothelial Growth Factor Injections. *American journal of ophthalmology*, *243*, 98-108. https://doi.org/10.1016/j.ajo.2022.07.025
- Sihota, R., Angmo, D., Ramaswamy, D., & Dada, T. (2018). Simplifying "target" intraocular pressure for different stages of primary open-angle glaucoma

and primary angle-closure glaucoma. *Indian journal of ophthalmology*, *66*(4), 495–505. https://doi.org/10.4103/ijo.IJO_1130_17.

- Sihota, R., Rao, A., Srinivasan, G., Gupta, V., Sharma, A., Dada, T., & Kalaiwani, M. (2017). Long-term scanning laser ophthalmoscopy and perimetry in different severities of primary open and chronic angle closure glaucoma eyes. *Indian journal of ophthalmology*, *65*(10), 963–968. https://doi.org/10.4103/0301-4738.216734.
- Tanna, A. P., & Johnson, M. (2018). Rho Kinase inhibitors as a novel treatment for glaucoma and ocular hypertension. *Ophthalmology*, *125*, 1741–56. [PMC free article] [PubMed] [Google Scholar].
- 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. https://doi.org/10.1016/j.ophtha.2014.05.013.
- Virno, M., Pecori-Giraldi, J., Liguori, A., & De Gregorio, F. (2000). The protective effect of citicoline on the progression of the perimetric defects in glaucomatous patients (perimetric study with a 10-year follow-up). Acta ophthalmologica Scandinavica. *Supplement*, *232*, 56–57. https://doi.org/10.1111/j.1600-0420.2000.tb01107.x.
- Wang, A., Qi, W., Gao, T., & Tang, X. (2022). Molecular Contrast Optical Coherence Tomography and Its Applications in Medicine. *International journal of molecular sciences*, *23*(6), 3038. https://doi.org/10.3390/ijms23063038.
- Weinreb, R. N., Aung, T., & Medeiros, F. A. (2014). The pathophysiology and treatment of glaucoma: a review. *JAMA*, *311*(18), 1901–1911. https://doi.org/10.1001/jama.2014.3192
- Xu, J., Ge, Y., Bu, R., Zhang, A., Feng, S., Wang, J., ... & Tang, X. (2019). Co-delivery of latanoprost and timolol from micelles-laden contact lenses for the treatment of glaucoma. *Journal of controlled release*, *305*, 18-28. [PubMed] [Google Scholar].
- Yang, W. H., Han, Q., Chen, S., & Yan, H. (2016). [Zhonghua yan ke za zhi] *Chinese journal of ophthalmology*, *52*(2), 104–109. https://doi.org/10.3760/cma.j.issn.0412-4081.2016.02.006.
- Zhang, H., Sun, Z., Li, L., Sun, R., & Zhang, H. (2020). Comparison of intraocular pressure measured by ocular response analyzer and Goldmann applanation tonometer after corneal refractive surgery: a systematic review and meta-analysis. *BMC ophthalmology*, *20*(1), 23. https://doi.org/10.1186/s12886-019-1288-6
- Zhang, X., Olson, D. J., Le, P., Lin, F. C., Fleischman, D., & Davis, R. M. (2017). The association between glaucoma, anxiety, and depression in a large population. *American journal of ophthalmology*, *183*, 37-41. https://doi.org/10.1016/j.ajo.2017.07.021.
- Zhao, D., Cho, J., Kim, M. H., Friedman, D. S., & Guallar, E. (2015). Diabetes, fasting glucose, and the risk of glaucoma: a meta-analysis. *Ophthalmology*, *122*(1), 72–78. https://doi.org/10.1016/j.ophtha.2014.07.051.