

**GLAUCOMA: AN OVERVIEW**

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**ABSTRACT**

Glaucoma is caused by elevated intraocular pressure (IOP) that leads to optic nerve damage and visual field loss & frequently called "the silent thief of sight". In 1862, Donders discovered that high intraocular pressure caused blindness and called the disease "Glaucoma simplex". It is the most frequent cause of irreversible blindness worldwide if left undiagnosed and untreated. This article gives an overview about types, mechanism, symptoms, causes, diagnosis and treatment of glaucoma.

**KEYWORDS:** Intraocular pressure (IOP), tonometry, trabeculectomy, trabeculoplasty, iridotomy, etc.

**INTRODUCTION**

Glaucoma is caused by elevated intraocular pressure (IOP) that leads to optic nerve damage and visual field loss. Glaucoma affects more than 70 million people worldwide with approximately 10% being bilaterally blind making it the leading cause of irreversible blindness worldwide. From a pathophysiological and therapeutic point of view, intraocular pressure is the primary modifiable risk factor, since progression of glaucoma usually stops if this pressure is lowered by 30–50% from baseline.<sup>[1,2,3,4]</sup>

Patients with glaucoma do not usually have any ocular or systemic symptoms. Glaucoma is frequently called "the silent thief of sight" because of the lack of symptoms in open-angle glaucoma. There are many different types of glaucoma, but the two main categories are open-angle and angle-closure glaucoma.<sup>[5,6]</sup> Glaucoma can remain asymptomatic until it is severe, resulting in a high likelihood that the number of affected individuals is much higher than the number known to have it. Population-level surveys suggest that only 10% to 50% of people with glaucoma are aware they have it.<sup>[7,8,9,10]</sup>

**Mechanism**

Your eye constantly makes aqueous humor. As new aqueous flows into your eye, the same amount should drain out. The fluid drains out through an area called the drainage angle. This process keeps pressure in the eye (called intraocular pressure or IOP) stable. But if the drainage angle is not working properly, fluid builds up. Pressure inside the eye rises, damaging the optic nerve.<sup>[11]</sup>

**Types of Glaucoma**

Glaucoma is not one disease but a group of eye diseases characterized by anatomical features, such as open angle (where the anterior chamber angle of the eye remains open) and angle closure (closure of the anterior chamber angle). The two broad categories of glaucoma. If the eye has no pre-existing disease, the glaucoma is considered primary. Patients who have glaucoma in an eye that had pre-existing disease are diagnosed with secondary glaucoma. There are several different types of glaucoma, and they have been classically divided into the categories of primary or secondary open-angle glaucoma and primary or secondary angle-closure glaucoma.

**1] Open-angle glaucoma**

Primary open-angle glaucoma is the most common type of glaucoma encountered in clinical practice. It is differentiated from angle-closure glaucoma by the gonioscopic appearance of the anterior chamber angle. Primary open-angle glaucoma is a diagnosis of exclusion in that there are no apparent preceding or associated ocular or systemic causes.<sup>[10]</sup>

Secondary open-angle type glaucoma is due to injury, eye disease, and rarely eye surgery causing increased intraocular pressure and, therefore, optic nerve damage like the open-angle form of glaucoma. One mechanism of secondary open-angle glaucoma is from laser surgery, which can cause pigment release, inflammatory cells, debris, and mechanical deformation resulting in blockage of the trabecular meshwork leading to increased intraocular pressure. The most common mechanism for the secondary open-angle type is from diseases causing neovascularization. Neovascularization can either physically block the outflow tracts.<sup>[12]</sup>

Steroids can induce secondary glaucoma due to increased outflow resistance by the upregulation of glucocorticoid receptors on cells within the trabecular meshwork and the accumulation of glycosaminoglycans in the

meshwork pores. Steroids also suppress phagocytic activity, which decreases debris deposition removal from the meshwork as well as stimulates the expression of extracellular matrix proteins.<sup>[13]</sup>

The figure 1 shows eye with an open angle glaucoma.<sup>[14]</sup>

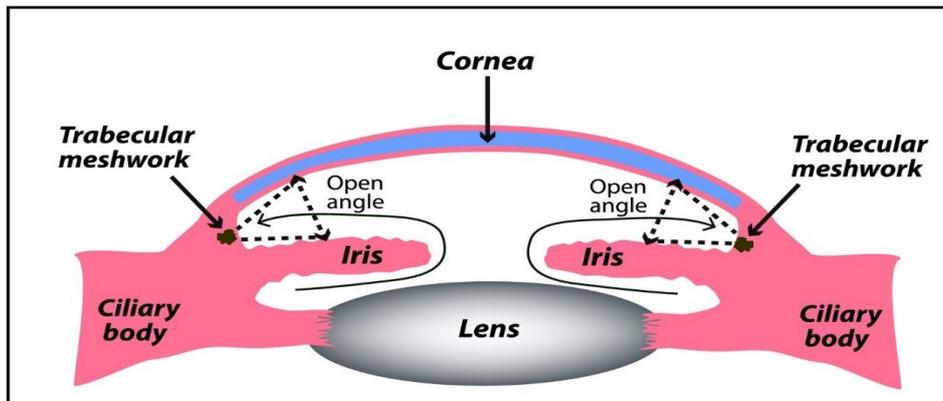


Fig. 1: Open angle glaucoma.

## 2] Angle-closure glaucoma

It is also known as narrow-angle glaucoma. Patients with primary angle-closure glaucoma may have dramatic signs and symptoms that can lead to permanent blindness in a short period of time if not properly treated. However, it is more common among women, elderly patients and patients with hyperopia or a positive family history of glaucoma.<sup>[15]</sup>

Angle-closure glaucoma occurs because aqueous humor cannot flow through the pupil into the anterior chamber (pupillary block), which increases the pressure behind the iris and forces the iris anteriorly (iris bombe) to occlude the anterior chamber angle. Acute angle-closure glaucoma may result if any stimulus dilates the pupil or causes the lens to move anteriorly. In most cases, acute angle-closure glaucoma occurs spontaneously. The symptoms of acute angle closure glaucoma can be quite dramatic and include severe ocular pain and redness, blurred vision, seeing halos around lights, headaches, and associated nausea and vomiting. The nausea and vomiting are sometimes mistaken for gastrointestinal

problems, which may delay the correct diagnosis. The Intraocular pressure can be extremely elevated in patients with acute angle closure glaucoma. Therefore, after the diagnosis has been confirmed by a thorough eye examination, topical and systemic antiglaucoma medications should be given immediately. The definitive treatment for angle closure glaucoma caused by pupillary block is the creation of an opening in the peripheral iris to allow the aqueous humor to flow between the posterior and anterior chambers of the eye. This procedure is called an iridectomy or iridotomy and can be performed by incisional or laser surgery. It is important to note that the anterior chamber angle may become progressively narrower over time due to the natural growth of the lens. Therefore, there is a risk that an open or borderline occludable anterior chamber angle may later lead to angle-closure glaucoma. As primary angle-closure glaucoma is usually a bilateral disease, patients with angle closure glaucoma in one eye have an increased risk of developing angle closure glaucoma in the other eye. Prophylactic laser iridotomy is usually recommended in these situations.<sup>[16]</sup>

The figure 2 shows eye with an angle closure glaucoma.<sup>[17]</sup>

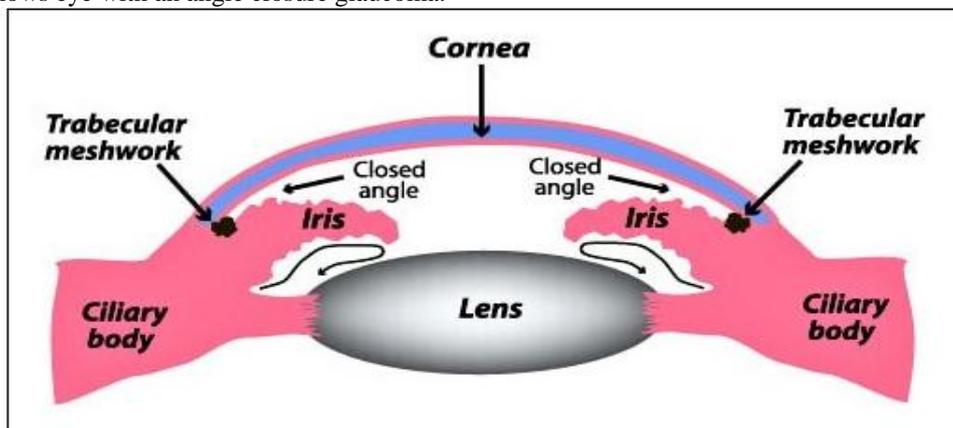


Fig. 2: Angle closure glaucoma.

**Symptoms**<sup>[18, 19]</sup>

Open-angle glaucoma is the most common type of glaucoma. It has no signs or symptoms except gradual vision loss. As the disease progresses, patchy blind spots develop in your peripheral (side) vision or central vision, frequently in both eyes. Most people with open-angle glaucoma do not notice any change in their vision until the damage is quite severe.

People at risk for angle-closure glaucoma usually show no symptoms before an attack. Some early symptoms of an attack may include blurred vision, halos, mild headaches or eye pain. An attack of angle-closure glaucoma includes the following:

- ❖ Severe headache
- ❖ Severe eye pain
- ❖ Nausea and vomiting
- ❖ Blurred vision
- ❖ Halos around lights
- ❖ Eye redness

**Causes**<sup>[20, 21]</sup>

1] The fluid inside your eye, called aqueous humor, usually flows out of your eye through a mesh-like channel. If this channel gets blocked, or the eye is producing too much fluid, the liquid builds up and results in increase in intraocular pressure and cause glaucoma.

2] The opening where the iris and cornea meet gets blocked by the outer edge of the iris cause angle-closure glaucoma.

3] The fluid passes too slowly through the spongy tissue in the opening where the iris and cornea meet. This causes fluid to build up in your eye, which increases the pressure inside of your eye and causes open-angle glaucoma.

4] Less-common causes of glaucoma include a blunt or chemical injury to your eye, severe eye infection, blocked blood vessels inside your eye, and inflammatory conditions.

5] Its rare, but eye surgery to correct another condition can sometimes bring it on. It usually affects both eyes, but it may be worse in one than the other.

**Diagnosis**<sup>[22, 23, 24, 25, 11]</sup>

1] The only sure way to diagnose glaucoma is with a complete eye exam. A glaucoma screening that only checks eye pressure is not enough to find glaucoma.

During a glaucoma exam, your ophthalmologist will:

- ❖ Measure your eye pressure.
- ❖ Inspect your eye's drainage angle.
- ❖ Examine your optic nerve for damage.
- ❖ Test your peripheral (side) vision.
- ❖ Take a picture or computer measurement of your optic nerve.
- ❖ Measure the thickness of your cornea.

2] Tonometry is an essential part of the diagnosis. Tonometry is a test to measure the pressure inside your eyes. The test is used to screen for glaucoma. It is also

used to measure how well glaucoma treatment is working.

3] Perimetric visual-field examination is the second technique in the diagnosis and follow-up of glaucomatous optic-nerve damage.<sup>7,47,48</sup> Many optic nerve fibres can be lost before perimetric defects are detected; therefore, the diagnostic precision of this technique increases with the stage of glaucoma.<sup>113</sup> Perimetry describes the subjective psychophysical defect as experienced by the patient, but it has fairly high intervisit variability, so at least three perimetric examinations could be necessary to detect visual-field deterioration reliably

4] Open-angle glaucoma is distinguished from angle closure glaucoma by gonioscopic examination of the anterior chamber angle.

**Treatment**<sup>[11, 26, 27]</sup>

Glaucoma damage is permanent. It cannot be reversed, but medicine and surgery help to stop further damage. To treat glaucoma, ophthalmologist may use one or more of the following treatments:

- 1] Medication
- 2] Laser surgery
- 3] Open room surgery
- 4] Cataract surgery

**1] Medication**

Glaucoma is usually controlled with eyedrop medicine used every day, these eye drops lower eye pressure. Some do this by reducing the amount of aqueous fluid the eye makes. Others reduce pressure by helping fluid flow better through the drainage angle.

The medications is also given to lower eye pressure these medicine classes include prostaglandin analogues, beta-blockers, carbonic anhydrase inhibitors, an alpha-2 agonist, miotic agents, and more recently rho-kinase inhibitors and nitric-oxide donating medications.

Glaucoma medications can help you keep your vision, but they may also produce side effects. Some eye drops may cause:

- ❖ a stinging or itching sensation
- ❖ red eyes or red skin around the eyes
- ❖ changes in your pulse and heartbeat
- ❖ changes in your energy level
- ❖ changes in breathing (especially if you have asthma or breathing problems)
- ❖ dry mouth
- ❖ blurred vision
- ❖ eyelash growth
- ❖ changes in your eye color, the skin around your eyes or eyelid appearance

All medications can have side effects. Some drugs can cause problems when taken with other medications. Be sure to talk with ophthalmologist if you think you may have side effects from glaucoma medicine. Never change

or stop taking your glaucoma medications without talking to your ophthalmologist.

## 2] Laser surgery

There are two main types of laser surgery to treat glaucoma. They help aqueous drain from the eye. These procedures are usually done in the ophthalmologist's office or an outpatient surgery center.

- a) **Trabeculoplasty:** This surgery is for people who have open-angle glaucoma. The eye surgeon uses a laser to make the drainage angle work better. That way fluid flows out properly and eye pressure is reduced.
- b) **Iridotomy:** This is for people who have angle-closure glaucoma. The ophthalmologist uses a laser to create a tiny hole in the iris. This hole helps fluid flow to the drainage angle.

## 3] Open room surgery

Some glaucoma surgery is done in an operating room. It creates a new drainage channel for the aqueous humor to leave the eye.

- a) **Trabeculectomy:** This is where eye surgeon creates a tiny flap in the sclera. He or she will also create a bubble (like a pocket) in the conjunctiva called a filtration bleb. It is usually hidden under the upper eyelid and cannot be seen. Aqueous humor will be able to drain out of the eye through the flap and into the bleb. In the bleb, the fluid is absorbed by tissue around your eye, lowering eye pressure.
- b) **Implantation of glaucoma drainage devices:** Ophthalmologist may implant a tiny drainage tube in your eye. The glaucoma drainage implant sends the fluid to a collection area (called a reservoir). Your eye surgeon creates this reservoir beneath the conjunctiva. The fluid is then absorbed into nearby blood vessels.
- c) **Cataract surgery:** Cataract surgery. In some cases, removing the eye's natural lens can lower eye pressure. This is most commonly done for people with narrow angles who have high eye pressure, signs of glaucoma, or both. With narrow angles, the iris and the cornea are too close together. If the angle is so narrow that the iris touches the cornea, it will also cover (block) the eye's drainage channel. Cataract surgery creates more space between the iris and cornea so that more fluid leaves the eye. This can lower eye pressure.

## CONCLUSION

From this review we concluded that the Glaucoma is a common eye disease that is usually associated with an elevated intraocular pressure (IOP). Glaucoma is a leading cause of blindness worldwide. The damage cause to the eye is permanent and irreversible, but medicine and surgery help to stop further damage. The risks and benefits of each type of treatment must be carefully considered to maximize the treatment's benefits while minimizing adverse effects.

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