

# Special Focus on Glaucoma

## Chapter 3

### An Overview of Glaucoma

*Rayees Ahmad sofi*<sup>1\*</sup>; *Prem chand kesarvani*<sup>2</sup>

<sup>1</sup>*Mbbs, MS (ophtho), fellow glaucoma Aaims New Delhi JK health services, India.*

<sup>2</sup>*Senior resident ophthalmology, RPC Aaims New Delhi.*

*\*Correspondence to: Dr rayees Ahmad sofi MBBS, ms (ophthalmology) Fellowship glaucoma aaims new Delhi Eye surgeon jk health services Srinagar, jk, india.*

*Email: rayees630@yahoo.co.in*

#### Abstract

The glaucoma is group of disorders characterized by progressive optic neuropathy having multiple risk factors ,the most important being the raised intraocular pressure. Most, but not all, of these diseases typically produce elevated pressure inside the eye, called Intraocular Pressure (IOP). Half of the people with glaucoma are usually unaware of it until a serious loss of vision has occurred. Glaucomas can be classified into 2 broad categories: open-angle glaucoma and angle-closure glaucoma. In the United States, more than 80% of cases are open-angle glaucoma; however, angle-closure glaucoma is responsible for a disproportionate number of patients with severe vision loss both open-angle and angle-closure glaucoma can be primary diseases.

#### VARIOUS DRUGS USED IN GLAUCOMA

##### Beta blockers

These reduce the production of aqueous humor. Examples include levobunolol , timolol , betaxolol and metipranolol. Possible side effects include difficulty breathing, slowed pulse, hair loss, lower blood pressure, impotence, fatigue, weakness, depression and memory loss.

- **Alpha-agonists:** These reduce the production of aqueous humor and increase drainage. Examples include apraclonidine (Iopidine) and brimonidine (Alphagan). Possible side effects include fatigue; dizziness; red, itchy or swollen eyes; dry mouth; and allergic reactions.

- **Carbonic anhydrase inhibitors:** These also reduce the production of aqueous humor. Examples include dorzolamide and brinzolamide . Frequent urination and a tingling sensation in the fingers and toes are possible side effects, occurring more often with oral carbonic anhydrase inhibitors than with anhydrase inhibitor eye drops.

- **Prostaglandin-like compounds:** These eye drops increase the outflow of aqueous humor. Examples include latanoprost, bimatoprost and travoprost. Possible side effects include mild reddening and stinging of the eyes and darkening of the iris, changes in the pigment of the eyelid skin, and blurred vision from swelling of the retina.

- **Miotic or cholinergic agents:** These also increase the outflow of aqueous humor. Examples include pilocarpine , and carbachol . Possible side effects are pain around or inside the eyes, brow ache, blurred or dim vision, nearsightedness, allergic reactions, a stuffy nose, sweating, increased salivation, and occasional digestive problems.

- **Epinephrine compounds:** These compounds, such as dipivefrin (Propine), also increase the outflow of aqueous humor.

- **Oral medications:** If eye drops alone don't bring your eye pressure down to the desired level, your doctor may also prescribe an oral medication. Doctors commonly prescribe carbonic anhydrase inhibitors, such as acetazolamide (Diamox Sequels) and methazolamide (Neptazane), for glaucoma. Take these pills with meals to reduce side effects.

## 1. Lasers

Nd Yag laser, selective laser trabeculoplasty (slt) and argon laser trabeculoplasty are few non surgical less invasive techniques to control intra ocular pressure.

### 1.1. Surgery

Surgeries used to treat glaucoma include

- TRABECULECTOMY.
- TRABECULOTOMY
- GONIOTOMY
- DRAINAGE DEVICES SHUNT SURGERIES

The glaucoma is group of disorders characterized by progressive optic neuropathy having multiple risk factors, the most important being the raised intraocular pressure. Fortunately

the most important risk factor, raised intraocular pressure is currently the only modifiable factor. Glaucoma affects all age groups although incidence differs [1].

Most, but not all, of these diseases typically produce elevated pressure inside the eye, called Intraocular pressure (IOP). Normal IOP is measured in millimeters of mercury and can range from 10-21 mm Hg. An elevated IOP is the most important risk factor for the development of glaucoma. Though many other factors like blood supply, postural drop, diurnal variation, etc factors do affect.

Half of the people with glaucoma are usually unaware of it until a serious loss of vision has occurred.

Many factors are associated with an increased risk of developing glaucoma, some of which are elevated IOP, a family history, ethnic background, and older age.

These are central nervous system neurons that have their cell bodies in the inner retina and axons in the optic nerve. Degeneration of these nerves results in cupping, a characteristic appearance of the optic disc and visual loss. [2] The biological basis of glaucoma is poorly understood and the factors contributing to its progression have not been fully characterized and understood.

Glaucoma affects millions of people worldwide with approximately 10% being bilaterally blind, making it the leading cause of irreversible blindness in the world. 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. Glaucomas can be classified into 2 broad categories: open-angle glaucoma and angle-closure glaucoma. In the United States, more than 80% of cases are open-angle glaucoma; however, angle-closure glaucoma is responsible for a disproportionate number of patients with severe vision loss. Both open-angle and angle-closure glaucoma can be primary diseases. Secondary glaucoma can result from trauma, some diseases, certain medications such as corticosteroids, inflammation, tumor, or conditions such as pigment dispersion or pseudo-exfoliation.

## **2. Primary Open-Angle Glaucoma**

### **2.1. Pathophysiology**

Although the pathogenesis of glaucoma is not fully understood, the level of intraocular pressure is related to retinal ganglion cell death. The balance between secretion of aqueous humor by the ciliary body and its drainage through 2 independent pathways—the trabecular meshwork and uveoscleral outflow pathway—determines the intra-ocular pressure. In patients with open-angle glaucoma, there is increased resistance to aqueous outflow through the tra-

becular meshwork. In contrast, the access to the drainage pathways is obstructed typically by their is in patients with angle-closure glaucoma.

Intraocular pressure can cause mechanical stress and strain on the posterior structures of the eye, notably the lamina cribrosa and adjacent tissues. [3] The sclera is perforated at the lamina where the optic nerve fibers (retinal ganglion cell axons) exit the eye. The lamina is the weakest point in the wall of the pressurized eye. Intraocular pressure–induced stress and strain may result in compression, deformation, and remodeling of the lamina cribrosa with consequent mechanical axonal damage and disruption of axonal transport [4,5] that interrupts retrograde delivery of essential trophic factors to retinal ganglion cells from their brainstem target (relay neurons of the lateral geniculate nucleus).

An examination of the eye may be used to diagnose glaucoma. However, checking the intraocular pressure alone (tonometry) is not enough because eye pressure changes. The doctor will need to examine the inside of the eye by looking through the pupil, often while the pupil is dilated.

Usually the doctor will perform a complete examination of the eyes.

Tests may include:

- Gonioscopy (use of a special lens to see the outflow channels of the angle)
- Intraocular pressure measurement by tonometry
- Optic nerve imaging (photographs of the interior of the eye)
- Pupillary reflex response
- Refraction
- Retinal examination
- Slit lamp examination
- Visual acuity
- Visual field measurement

### **3. Various Drugs Used in Glaucoma**

Medical therapy remains the most common initial method of lowering IOP and usually involves topical agents delivered as eye drops [6,7,8]. There are several effective classes of topical therapies for glaucoma, including prostaglandin analogues (PGAs),  $\beta$ -blockers,  $\alpha$ -adrenergic agonists and carbonic anhydrase inhibitors (CAIs), and pilocarpine. These topi-

cal therapies reduce the production of aqueous humour, enhance its outflow, or have an effect on both.

**Beta blockers:** These reduce the production of aqueous humor. Examples include levobunolol , timolol , betaxolol and metipranolol. Possible side effects include difficulty breathing, slowed pulse, hair loss, lower blood pressure, impotence, fatigue, weakness, depression and memory loss.

- **Alpha-agonists:** These reduce the production of aqueous humor and increase drainage. Examples include apraclonidine (Iopidine) and brimonidine (Alphagan). Possible side effects include fatigue; dizziness; red, itchy or swollen eyes; dry mouth; and allergic reactions.

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- **Oral medications:** If eye drops alone don't bring your eye pressure down to the desired level, your doctor may also prescribe an oral medication. Doctors commonly prescribe carbonic anhydrase inhibitors, such as acetazolamide (Diamox Sequels) and methazolamide (Neptazane), for glaucoma. Take these pills with meals to reduce side effects. Add bananas and apple juice to your diet to minimize the potassium loss caused by these medications.

- Initially, carbonic anhydrase inhibitors may cause frequent urination and a tingling sensation in your fingers and toes. After several days, these symptoms usually disappear. Other possible side effects of carbonic anhydrase inhibitors include rashes, depression, fatigue, kidney stones, lethargy, stomach upset, a metallic taste in carbonated beverages, impotence and weight loss.

## 4. Lasers

Nd Yag laser, selective laser trabeculoplasty (slt) and argon laser trabeculoplasty are few non surgical less invasive techniques to control intra ocular pressure.

### 4.1. Surgery

Surgeries used to treat glaucoma include

- **TRABECULECTOMY:** In the last couple of decades, a procedure called trabeculoplasty has had an increased role in treating open-angle glaucoma. After giving you an anesthetic eye drop, the doctor uses a high-energy laser beam to open clogged drainage canals and help aqueous humor drain more easily from the eye.
- **TRABECULOTOMY**
- **GONIOTOMY**
- **DRAINAGE DEVICES SHUNT SURGERIES**

## 5. Some Adjustments Patients of Glaucoma can Make in their Day to Day Life

People with low vision can live independently in their own homes, continue to carry out daily activities and take pleasure in hobbies. In the home, remember the following general guidelines: increase lighting for tasks; control glare; use magnification; and increase contrast. Over time, people with low vision will likely come up with individual, innovative solutions to reflect their needs, help them function better in the home and increase their enjoyment of life. Seek help through friends, family and volunteer groups to implement these adaptations.

## 6. Improving other Senses

### 6.1. Hearing Better

Listening to books on tape and CDs, and using listening skills more may seem difficult at first, but will become easier over time. After an initial period of adjustment, most people with low vision are surprised to find out how much information they can obtain from their senses of hearing, touch and even smell.

Listening more means remembering more. Most people never fully develop the ability to remember what they hear because there is no need. Improving listening skills means giving full attention to what is heard rather than dividing attention between what is seen and what is heard. Those with low vision may still receive visual cues from eyesight, but most of their attention will now need to be shifted to listening. As people grow more accustomed to listening to books, newspapers and magazines on tape and CDs, and working with screen-reader

software, gradually more of what is heard will be remembered.

People can learn to “tune in to” their sense of hearing in many practical ways that will assist in daily activities. For example, learning to locate the sound of the hum of the refrigerator can signal you are entering the kitchen. Or, the sound of cars and other outside street noises will indicate an open window and its location.

## **6.2. Using touch**

Those with low vision can also learn to rely more on the sense of touch in many practical ways. Selecting clothes from the closet, for example, will be easier if a person focuses on the textures of fabrics and associates them with mental pictures of certain garments.

When there is severe vision loss, using a cane or walker outdoors allows an individual to use the sense of touch to get more information about the environment. These “feelers” will help detect changes in the pavement, the closeness of objects and the presence of stairs. Even without a cane or walker, using the feet to feel the way, especially when climbing or descending stairs, can augment diminished vision and prevent dangerous falls.

## **6.3. Protection from the Sun**

While excessive exposure to sunlight has not been linked to glaucoma, protection from the sun’s ultraviolet (UV) radiation is a good idea. UV radiation is composed of invisible, high-energy, sunlight just beyond the violet or blue end of the visible spectrum. It is usually divided into three categories of radiation, UV-C, UV-B and UV-A. UV-C radiation is absorbed in the ozone layer, but UV-A and UV-B are damaging to skin and eyes.

To protect eyesight, physicians recommend sunglasses that block 98-100 percent of both UV-A and UV-B rays and screen out 75-90 percent of visible light. Sunglasses don’t have to be expensive, but they should be properly labeled. Those that meet minimum standards established by the American Optometric Association (AOA) can use the AOA seal of acceptance. The best sunglasses are those that completely cover the eye and eyelids, and wrap around to the temples to prevent light from entering the sides. Brimmed hats provide additional protection.

## **7. Ways to Make Life Easier**

- Dealing with any loss of vision isn’t easy, but there are a variety of physical and psychological ways people with glaucoma and their families can adjust to “a new way of seeing.”
- Consult a low vision therapist who can make personalized recommendations for daily living activities. More information can be found on our website.

- Consider using low vision aids.
- Measure your own eye pressure by using a portable tonometer. Portable tonometers allow people to check eye pressure at home. Correct use of these tonometers requires training, but they can be helpful for those who have difficulty visiting a doctor for multiple readings that may be needed for an accurate diagnosis. The patient (or family member) can take readings at various times of the day, per a doctor's instructions, and then bring the results to the doctor for the final reading. Check with a physician about the practicality and affordability of portable tonometers.

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