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# **GUIDE**

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## **Glaucoma**



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**The Ottawa | L'Hôpital  
Hospital | d'Ottawa**



***Disclaimer***

*This is general information developed by The Ottawa Hospital. It is not intended to replace the advice of a qualified healthcare provider. Please consult your own personal physician who will be able to determine the appropriateness of the information for your specific situation.*

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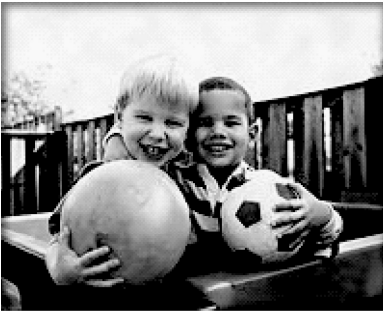
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# Introduction

This booklet is intended to help you and your family/ friends understand glaucoma. We hope that by reading this, you will have a better understanding of your role in preventing loss of vision.

Glaucoma is one of the leading causes of blindness in Canada. The loss of sight related to glaucoma is preventable but irreversible. Early detection and proper treatment may prevent vision loss that is caused by glaucoma.



*Normal Eye*



*Eye with early glaucoma*

## What is glaucoma?

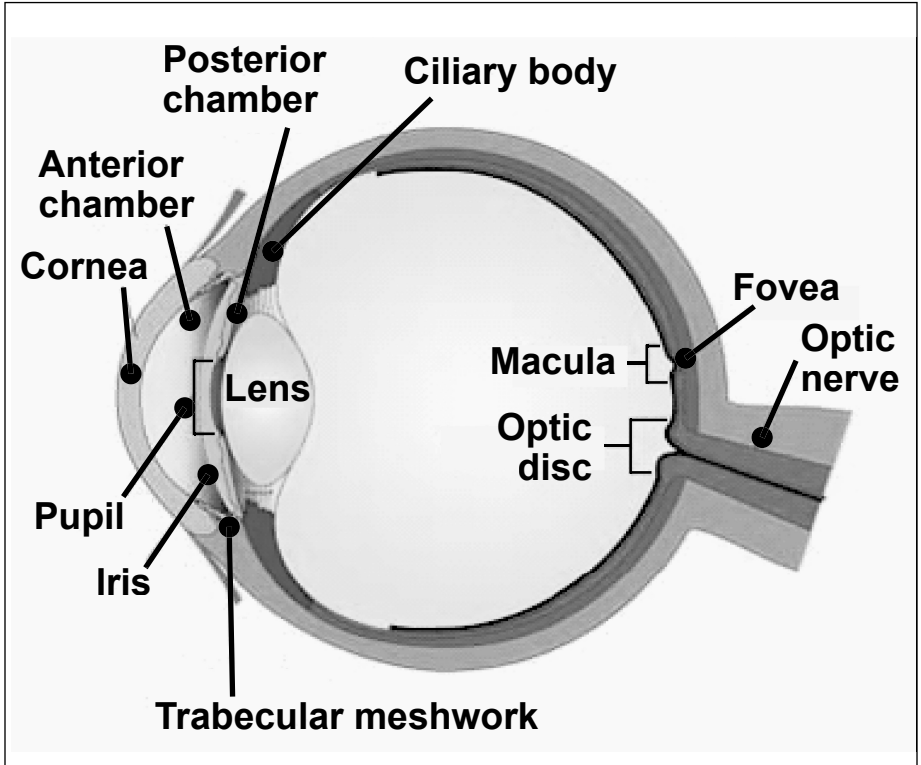
Glaucoma is a generally **painless** eye disease, in which damage occurs to the **optic nerve**, causing **vision loss**. It is often linked with a build-up of pressure within the eye.

The optic nerve is located at the back of the eye and connects the eye to the brain. It contains nerve cells that transmit images from the eye to the brain so we can see these images. In glaucoma, the nerve cells slowly die, causing changes in vision.

At first, blind spots occur in the peripheral (side) vision and then they progress to the central vision. If the glaucoma is untreated, the blind spots may progress to total loss of vision. Patients may not know they have glaucoma until the disease is quite advanced. Glaucoma can cause total blindness within a few years if not treated.

Glaucoma is sometimes called the **“silent thief of sight”** because symptoms are often not apparent until the condition has damaged most of the optic nerve fibers. Every year, many Canadians needlessly go blind because their glaucoma was detected too late. Ophthalmologists and optometrists can **easily diagnose glaucoma** through routine eye examinations. Early detection and treatment are the keys to preventing the loss of sight.

# The normal eye – side view



## What is the cause of glaucoma and who is at risk?

The cause of glaucoma is not known, but research shows that there is a hereditary component to glaucoma. Glaucoma can affect anyone, but there are some people who are more at risk for developing glaucoma. The risks factors are:

- High intraocular pressure (IOP) – major risk factor
- Increasing age

- A family history of glaucoma
- Being of African or Hispanic descent
- Chronic use of steroids pills, puffers or nasal sprays (corticosteroids)
- Previous eye trauma or injury
- Diabetes, high blood pressure and low thyroid function

## **What is intraocular pressure?**

The intraocular pressure, referred to as **IOP**, is the pressure inside your eyes. Within the normal eye, there is a constant production and drainage of a fluid called the **aqueous** humor. This fluid nourishes the lens and the cornea. It helps maintain a constant pressure in the eye. If the eye pressure is too high, it can cause damage to the optic nerve. If the pressure is too low, the eye may not function normally.

The average eye pressure tends to change slightly during the course of a day, and from one day to the next. It also varies with ethnic origin.

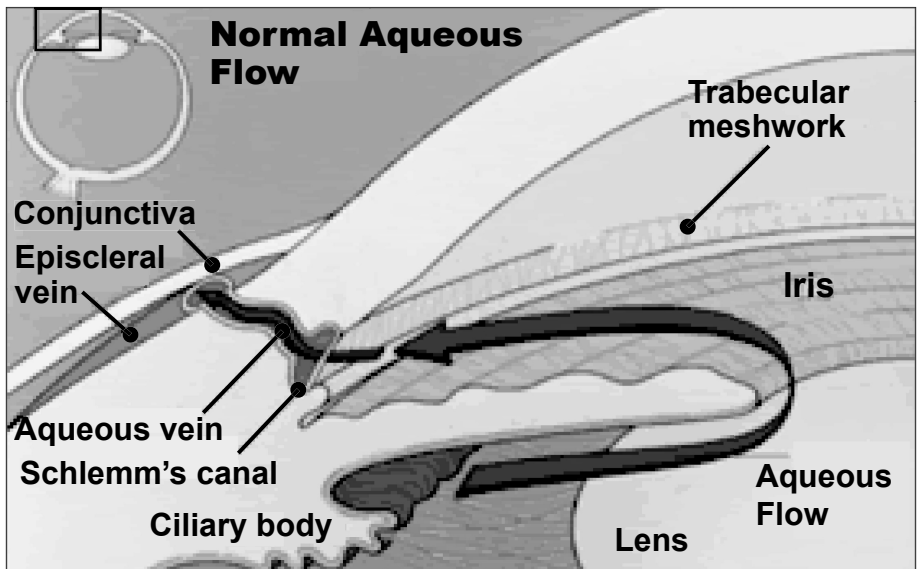
In most cases of glaucoma, the intraocular pressure is elevated. This is the most important risk factor in developing glaucoma.



# What are the types of glaucoma?

There are 2 major types of glaucoma: open angle glaucoma and closed-angle glaucoma. Glaucoma is classified according to the shape of the angle where the fluid drains out of the eye. The aqueous humor is produced by the ciliary bodies. The aqueous humor flows through the pupil to the anterior chamber of the eye and drains out through the trabecular meshwork.

## Front of the eye

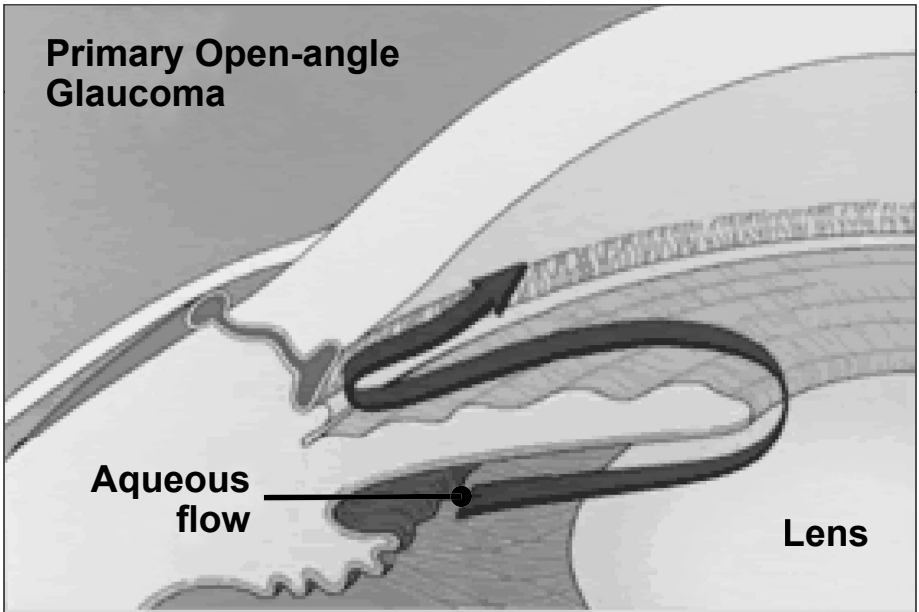


**Diagrams showing the drainage of the fluid in the normal eye.**

# **Open-angle glaucoma**

Open-angle glaucoma: Is also called chronic or primary open-angle glaucoma. This is the most common type of glaucoma in Canada. It represents 80 to 85% of all cases. A person has open-angle glaucoma if the drainage system is opened but not functioning as well as it should. The aqueous humor cannot drain easily and the pressure in the eye increases. A continued elevated pressure will cause damage to the optic nerve. The eye examination will show the changes to the optic nerve.

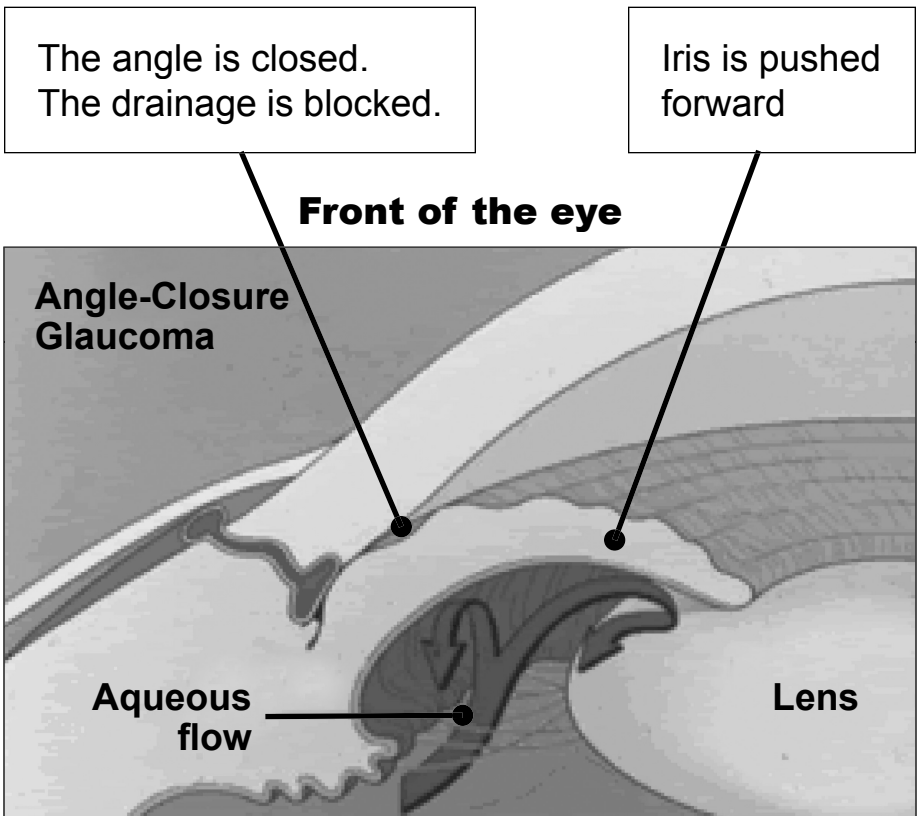
## **Front of the eye**



**In this diagram, the fluid has difficulty draining out of the eye.**

# **Angle-closure glaucoma**

Angle-closure glaucoma (closed-angle glaucoma): It represents a little less than 10% of all cases of glaucoma. This type of glaucoma is less common in North America. The colored part of the eye (the iris) is pushed forward and closes the angle where the drainage takes place. This causes a build up of fluid within the eye as the drainage becomes blocked. It can be chronic or acute.



**In this diagram, the angle is closed and the fluid cannot escape.**

# ***Acute angle-closure glaucoma***

## **This is an emergency!**

If the iris blocks the angle quickly, the fluid cannot get out of the eye and the pressure within the eye increases rapidly to very high levels. Permanent visual loss may occur within hours if not treated.

## **Contact your ophthalmologist immediately or go to an emergency department if you have the following symptoms:**

- Severe eye pain and/or headache with or without redness
- Blurred vision
- Seeing colored halos around lights
- Nausea and vomiting

## **Normal-tension or Low-tension Glaucoma:**

Approximately 30% of patients with open-angle glaucoma will fall into this category. The eye examination and visual fields tests show some damage to the optic nerve, but the intraocular pressure is not elevated.

## **Congenital Glaucoma/Childhood Glaucoma:**

It starts at birth, in infancy or during childhood. It is rare (1 in 15,000) and has different causes that include improper development of the eye's drainage system. When a baby has congenital glaucoma, it is not rare to hear people comment on how "huge" the baby's eyes are.

**Secondary glaucoma** is any type of glaucoma where there is a known cause, such as trauma to the eye, pseudoexfoliation, inflammation inside the eye or ocular vascular occlusion.

### **Ocular Hypertension or Glaucoma Suspect.**

Finally, high intraocular pressure does not always cause optic nerve damage. Some individuals have elevated eye pressure but do not show optic nerve damage or blind spots. They do not suffer from glaucoma but have a condition known as Ocular Hypertension or Glaucoma Suspect. These people are at a greater risk for developing glaucoma, and require regular follow-up eye examinations.

## **The eye examination**

Having a complete eye examination on a regular basis is the first defense against vision loss from glaucoma. Everyone should have a regular eye examination, every 3 to 5 years. If you are over the age of 50 or if you have any risk factors for glaucoma, you should have your eyes checked every 1 or 2 years or more often is necessary.

If you have glaucoma, examinations are usually required between one and three times a year. If the glaucoma responds well to the treatment and the condition remains stable, visits may only be needed once a year. On the day of your examination, you must **apply your regular eye drops as prescribed.**

An **ophthalmologist** is a medical doctor, who following his 4 years of medical training, specializes for another five years in Ophthalmology. Following this, some ophthalmologists spend one or two more years studying glaucoma, the retina or the cornea. An ophthalmologist may have a part of the exam performed by a certified ophthalmic technician or a certified ophthalmic medical technologist.

An **optometrist** has studied the normal eye and diseases of the eye for four years at a University. He or she can not perform surgery nor laser treatments. He has a good knowledge of the eye and is able to distinguish between a normal and diseased eye. If you require glasses, the optometrist is able to measure the refraction in your eyes. You must continue to consult your optometrist as required even if you are being seen by an ophthalmologist.

An **optician** is a person who makes glasses. The optician does not conduct an eye examination. Having studied at a college, the optician is able to adjust your glasses and help you choose the best ones for you.

# How is glaucoma diagnosed?

A thorough glaucoma examination includes the following:

## Medical History

At the beginning of your examination, one of the eye care professionals will ask you questions about your medical and family history. Be sure to bring a list of all your medications, as this will help the doctor understand your particular situation.

## Optic Nerve Examination

The most important part of the glaucoma eye examination is assessing the optic nerve for signs of damage. The doctor will examine your eyes through the **slit lamp**, the standard piece of equipment.

In order to properly view the optic nerve, the doctor may need to enlarge (dilate) your pupils with drops. After a few minutes, the doctor will shine a bright light into the eye, and closely examine the optic nerve using a small lens in front of the eye. The doctor may also place a headlight apparatus (indirect ophthalmoscope) on his/her head and hold a lens close to your eyes. Although it may seem very bright, the light does not cause any harm to the eye.

The complete eye examination takes several minutes and can be done more quickly if the patient can hold his/her eyes still and avoid squeezing his/her eyes.

After the examination, it normally takes 5 to 10 minutes for the vision to clear, and 4 to 6 hours for the pupil to return to its normal size. During this time, reading may be difficult and your eyes may be very sensitive to light. It is a good idea to bring sunglasses with you to the examination. **It is better to have someone drive you home because the dilating drops will cause your vision to become blurry.**

### **Intraocular Pressure (IOP) Measurement**

This is called Tonometry. The measurement of the pressure inside your eye is essential. Freezing (anesthetic) drops are instilled in your eyes and a device called a tonometer is used. Tonometry takes only a second and is painless. Be careful not to touch your eyes for about 20 minutes after the drops are placed in your eyes, as the sensation in your eyes will be diminished.

The “normal” intraocular pressure (IOP) is usually between 10-21 mmHg. When glaucoma is detected in a patient, the ophthalmologist may establish a target pressure for that particular patient that may not be between that range.

### **Pachymetry**

The thickness of your cornea (clear portion in front of the eye) can affect the reading of the eye pressure. It will be measured with an instrument called a pachymeter while the freezing drops still have an effect.



## **Gonioscopy**

In order to see if a person has open-angle or close-angle glaucoma, a special lens (gonioscopy lens) is placed on the eye to view the drainage system of the eye. Thanks to the temporary “freezing” drops, this examination is comfortable, although it may feel unusual.



## **Visual Field Testing**

Visual field testing is an important tool to detect and monitor blind spots caused by glaucoma. The size of your visual field is the furthest you can see to the side when looking straight ahead. This test is important to make sure there are no abnormal blind spots in your vision.

A technician who is trained to help you get the most accurate reading possible conducts the test. While you are seated, the technician will ask you to look straight ahead at a central target directly in front of you. You will be instructed to press a buzzer when you become aware of a small light to one side, within your peripheral field. Once the computer prints out the results from this test, your eye doctor can easily detect blind spots in your visual field.

## **New Technologies**

There are several technologies now available that can help detect early damage to the optic nerve. These include Optical Coherence Tomography (OCT), specialized Electroretinography (ERG) tests and the Confocal Scanning Ophthalmoscope (HRT). Your doctor can tell you more about these technologies.

## **What is the treatment for glaucoma?**

The treatment for glaucoma is aimed at achieving a **target pressure** for your eye. There are 3 options available to decrease the intraocular eye pressure: medications, laser and surgery. If medications fail to lower the IOP to the target pressure level and nerve damage continues to occur, your target pressure will be lowered and further medication, laser treatment or surgery may be required.

# Medical therapy

There are many types of medications now available to safely and effectively reduce intraocular pressure. They work either by:

- Reducing the production of fluid inside the eye,
- Or increasing the drainage of the fluid out of the eye.

Occasionally, a new eye drop is started in only one eye and the pressure is compared to the other untreated eye. If it works well with little side effects, the medication may be used in both eyes. Often one or more additional drops are needed to reach the target pressure.

Oral medication can also be used to treat glaucoma when the pressure is difficult to manage. In case of emergencies such as acute angle-closure glaucoma, intravenous medications may be used.

The different groups of glaucoma medications are presented here. **Speak to your doctor or pharmacist** if you have any questions or concerns and ask your doctor about possible side effects.

## ***Prostaglandin analogs***

Available since 1996, they are the most common type of eye drops used today for glaucoma.

*Generic names:* **Latanaprost, Travoprost and Bimatoprost**

*Action:* Increase the drainage of fluid from the eye.

*Side effects:* These medications have been associated with side effects such as darkening of the color of the iris and an increase in the thickness, length and number of eyelashes. Occasionally, some people may experience increased redness of the eye, especially for the first few weeks after starting treatment.

## ***Beta-blockers***

These drops have been on the market since 1978.

*Generic names:* **Timolol**, **Levobunolol**, and **Betaxolol**

*Action:* Reduce the production of aqueous humor within the eye.

*Side effects:* They are generally well tolerated. Patients who have a history of asthma or heart problems (especially congestive heart failure and heart block) are generally advised not to take this medication. It can make their problems worse.

It is important to advise your doctor if you have any changes in the status of your health.

## ***Sympathomimetics***

These drops may be added as a 2<sup>nd</sup> medication to treat glaucoma.

*Generic names:* **Apraclonide** and **Brimonidine**

*Action:* Reduce the production of aqueous humor.

*Side effects:* They may cause an ocular allergy, characterized by itchiness and redness of the conjunctiva and eyelid. These symptoms generally appear within a few weeks to months after starting treatment, and may require discontinuation of the drops. Brimonidine may cause changes in blood pressure and energy level and should not be used in very young children. Both of these medicines may cause a dry mouth.

## ***Carbonic anhydrase inhibitors (CAI's)***

They come in 2 forms, either eye drops or oral tablets.

*Generic names:* **Acetazolamide** (drops or pills), **Brinzolamide, Dorzolamide, Metazolamide**

*Action:* Reduce the production of aqueous humor.

*Side effects:* The eye drops may be less effective than the tablets but have fewer serious side effects. The drops may sting when they are applied. Some patients notice a change in their taste perception.

Both the tablets and drops are related to sulfa medications. Those with a **sulfa allergy** should discuss this situation carefully with the doctor, if these medications are being considered.

# **Miotics**

*Generic names:* **Pilocarpine** and **Carbachol**

*Action:* These medications cause the pupil to become smaller, which helps the drainage of the fluid.

*Side effects:* They may cause changes in vision including darkening or dimming of the vision and aching around the eye or brow area. These effects wear off after a few weeks. Driving at night may be difficult.

**Combination medications** are more and more common as two types of medications are combined in one bottle. These have the advantage of less daily drops to use.

# **Laser therapy**

Lasers are devices that focus light energy very precisely. A few laser instruments are used to control eye pressure in glaucoma.

**Argon Laser Trabeculoplasty (ALT):** It has been in use for almost 30 years. It can be quite effective in lowering the eye pressure. In this procedure, the laser light is focused on the drainage angle of the eye (the trabecular meshwork) to increase the drainage of the fluid out of the eye. The treatment is usually painless and takes less than 10 minutes.

Intraocular pressure is usually checked one hour after the treatment to make sure it is not rising. Possible side effects include elevation in IOP or inflammation in 3 to 5% of patients undergoing this procedure. **You should plan not to drive after this treatment**, as your vision may be blurry for several hours. Your doctor may recommend steroid drops to reduce inflammation after the treatment.

The success rate (lowering the eye pressure) is approximately 85%, one year after the procedure. The effect may slowly wear off over time. The treatment can be repeated once if necessary, although there is a slightly higher risk of side effects.

A **Selective Laser Trabeculoplasty** (SLT) is a newer way of doing laser trabeculoplasty. SLT appears to be essentially equivalent to ALT. Your doctor will choose the best treatment for you.

See our booklet ***Glaucoma Laser Treatment*** for more information.

**Laser iridotomy** is used when angle-closure glaucoma occurs. The physician uses the laser connected to the slit lamp and creates an opening in the iris. This allows the fluid to flow into the anterior chamber. It flattens out the iris, which opens up the drainage system so that the fluid can flow out more easily.

# **Surgery**

In North America, glaucoma surgery is generally not done unless medical and laser therapy have been inadequate to control the IOP.

## ***Trabeculectomy***

The operation most frequently performed is called a Trabeculectomy. The surgeon makes a small hole through the sclera (white part of the eye), which allows fluid to drain out of the eye more easily. This operation is usually done under local anesthesia (freezing). It takes about 45-90 minutes and the patient usually goes home shortly after the procedure. The patient wears an eye patch and comes back to see the surgeon the next day. The operation is usually not painful or there might be slight discomfort afterwards. This can be relieved by over the counter pain medications (as prescribed by your doctor).

Trabeculectomy is quite successful in terms of lowering intraocular pressure below target level. However, the chances of success depend on many factors. Your doctor is in the best position to discuss the chances of success in your eye. The main reason for failure of a trabeculectomy is that scar tissue may block the new drainage channel. Many ophthalmologists use a special chemical such as Mitomycin-C at the time of surgery, to prevent the formation of scar tissue and increase the success rate of the surgery.



The main complications of trabeculectomy involve inflammation following surgery and gradual failure of the drainage system. It is also important to remember that in the initial period after surgery, your eye pressure may be slightly high or too low. Other complications include the risk of bleeding, infection and poor vision. Your doctor can discuss these with you as they may affect your vision for days or weeks. Normally, vision returns to the level it was before surgery within approximately one month.

In some cases, when cataracts and glaucoma coexist, the surgeon may offer a **combined procedure** by removing the cataract and performing a glaucoma procedure at the same time.

## ***Iridectomy***

Another surgery for glaucoma is called Iridectomy. If necessary, it is performed with the trabeculectomy. It is the removal of a small section of the iris tissue (the colored part of the eye). It may be performed urgently when laser iridotomy is not feasible in acute angle-closure glaucoma.

## ***Valve implant***

The surgeon may decide to use a valve implant or tube shunt when a trabeculectomy is not possible, or has not succeeded. These devices consist of a silicone tube attached to a plate. The fluid drains out of the tube to control the pressure of the eye.

## ***Endoscopic cyclophotocoagulation***

Laser Cyclophotocoagulation (CPC) is used in eyes with poor vision when other treatments have failed to lower the IOP. A laser is used to destroy part of the ciliary body, source of the aqueous humor. This has the effect of turning down the faucet and thus lowering IOP.

## ***Trabectome surgery***

This newer surgical procedure improves the drainage of the fluid. A small amount of trabecular meshwork is removed to create a direct access to the eye's normal drainage channels.

## **What should I expect after glaucoma surgery?**

After surgery, a registered nurse will instruct you and your family regarding activity level, putting in drops and/or using an eye shield. You will be given written instructions as well.

### **You must seek medical attention immediately if:**

- you have severe pain anytime after the operation,
- your vision drops suddenly,
- your eye (or eyelids) swells up,

- you have increased discharge,
- you have uncontrolled nausea and vomiting.

**Call your surgeon or call the Eye Institute at: 613-737-8575 or go to the Emergency Department.**

## **What can I do to keep my glaucoma under control?**

**Patient compliance** is the most important factor to prevent increase of intraocular pressure. Medications must be taken as prescribed, because **glaucoma is painless unless it is acute**. You may not feel like you need to take your medications, but you must take them regularly, **even if you feel fine or experience temporary eye redness**. It is the best way to manage glaucoma and prevent or delay any further vision loss.

Remembering to take your eye drops is easier if you make it part of your daily routine. Medications should be taken at around the same time every day. If you must take your eye drops twice a day, consider noontime and bedtime for your schedule, or breakfast and dinner. If you have to take eye drops 4 times a day, you might want to take them with your meals and at bedtime.

Take note of any side effects that persist and discuss them with your ophthalmologist at your next visit or contact the ophthalmologist or the ophthalmology nurse by telephone.

## **General health and exercise**

Continue your sporting activities and eat well. We put all the chances on our side when we lead a healthy life. There are no special diets or foods to avoid. The consumption of alcohol, wine or beer, and caffeine in reasonable quantities, is not restricted. Tobacco, on the other hand, is not good for the health in any quantity. Smoking constricts the blood vessels and may contribute to blood vessel damage in your eyes.

If you have high blood pressure, ensure that it is well controlled and see your family physician regularly. High blood pressure may also damage small vessels in your eyes.

If you are diabetic, maintain your blood sugar level within normal range. Another complication of diabetes is diabetic retinopathy, a disease of the retina. Combined with glaucoma, vision loss can lead to total blindness.

**Most of all continue to enjoy life!**

# **Are there contraindications to other medications when I have glaucoma?**

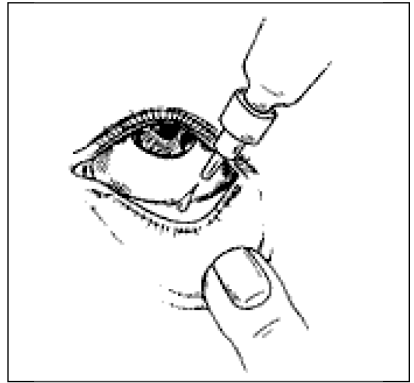
Some medications, such as antihistamines, cough suppressants, antidepressants and others, come with warnings that refer to patients who have or are at risk for angle-closure glaucoma. This refers only to a small group of patients with glaucoma. These medications carry a warning for glaucoma because they can result in enlargement of the pupil. Rarely in these patients, will this lead to an attack of acute angle-closure glaucoma, an emergency.

In general, individuals who have had laser iridotomy and those with open angle glaucoma do not need to worry about taking over-the-counter medications. However, the safest thing to do is to check with your eye doctor.

## **How do I apply eye drops?**

1. First, wash your hands.
2. Read the label to ensure you have the right medication.
3. You may find it easier to put your eye drops in while lying down or sitting with your head tilted backwards.
4. Shake the bottle.

5. Pull down on your lower lid with your middle finger and look up. Some patients prefer to use the thumb and index to make a pocket with the lower eyelid.



6. Hold the bottle in the other hand and apply the drop in your eye. **Do not** let the dropper touch your eye to prevent contamination of the drops.
7. Close your eye gently for 2 minutes.
8. Press the inner corner of your eye with your index for a minute to prevent absorption of the medication through the blood vessels inside your nose. This will diminish the risk of side effects. If you apply drops in both eyes, use your thumb and index.
9. Wipe off the excess of medication from your cheek(s) with a tissue.
10. Wait 3 to 5 minutes if you have to use another type of eye drops.
11. You do not have to wake up at night to take your eye drops. Just follow a regular daytime schedule.
12. Opened bottles are usually good for one month and should be discarded afterwards to prevent risks of infection. However, ensure you have a new bottle to continue your drops!

## **Can I still drive?**

Most of the time, having glaucoma will not prevent you from driving. However, physicians are required by law to inform the Ministry of Transportation of Ontario (MTO) when a person has decreased visual acuity or visual fields impairments. The Ministry can then ask that the person undergoes certain tests.

Drivers of 80 years of age and over must contact the MTO once they receive their renewal notice. They will need to schedule an appointment for a vision test, a written test and a group education session. This will all be done in a period of approximately 3 ½ hours.

## **Can I travel?**

As long as your glaucoma is stable, you can travel and you can purchase travel insurance. If in doubt, contact your agent. Don't forget your eye drops!

## **Psychological aspect**

Illness always has an impact on the emotions and thoughts of the person involved. You may go through different emotions before you accept the disease. Some people develop a sense of inferiority and dependence when dealing with others.

## **The following suggestions can help you live with glaucoma:**

- Acquire a good understanding of glaucoma.
- Participate actively in the treatment. Learn how to apply your eye drops and arrange your own appointments
- Involve your family and friends to obtain their support and discuss your fear of losing your sight.
- Maintain a positive attitude and hope. A lot of progress has been made in the treatment of glaucoma during the last 20 years.

## **Conclusion**

Research on glaucoma is on-going. Researchers are trying to identify the gene responsible for glaucoma and thereby be enabled to identify families at risk. It is reasonable for individuals at risk of developing glaucoma to hope to keep their sight all their life. Above all, a regular contact with your ophthalmologist and a strict adherence to your treatment are the key elements to maintain your vision for the rest of your life.

Glaucoma, well controlled, will increase your sense of well-being and improve your quality of life.



We hope the information included in this booklet has been helpful to you. If you have any more questions, do not hesitate to ask your ophthalmologist, your ophthalmic technician/technologist or your ophthalmology nurse at The Ottawa Hospital, or visit our websites.

- [www.ottawahospital.on.ca](http://www.ottawahospital.on.ca)

## **Supporting organizations**

There are organizations in the community that can give you and your family members different types of assistance.

### **The Canadian Glaucoma Society**

1525 Carling St., Suite 610

Ottawa, ON K1Z 8R9

Web: [www.cgs-scg.org](http://www.cgs-scg.org)

### **The Canadian National Institute for the Blind (CNIB)**

1101 Prince of Wales Dr., Suite 135

Ottawa, ON K2C 3W7

Tel: 613-563-4021

Toll-free Tel: 1-866-842-9071

## **Patient Education Session on Glaucoma**

Call The University of Ottawa Eye Institute at 613-737-8575 for the schedule.

### **Other websites**

- [www.alcon.com](http://www.alcon.com)
- [www.allergan.com](http://www.allergan.com)
- [www.cos-sco.ca](http://www.cos-sco.ca)
- [www.myglaucoma.ca](http://www.myglaucoma.ca)
- [www.pfizer.ca](http://www.pfizer.ca)

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3. Information on medications published by Pharmaceutical Companies.
4. Previous University of Ottawa Eye Institute Patient Information Booklet on Glaucoma, 1992.

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Prepared by Pascale Rinfret RN, BScN

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Nurse Educator, University of Ottawa Eye Institute

Approved by Dr. Karim Damji MD, FRCSC, MBA

# Notes

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