What Is Glaucoma?

Glaucoma is a disease that damages the eye's optic nerve. The optic nerve is connected to the retina — a layer of light-sensitive tissue lining the back of the eye — and is made up of many nerve fibers, like an electric cable is made up of many wires. It is the optic nerve that sends signals from your retina to your brain, where these signals are interpreted as the images you see.

In the healthy eye, a clear fluid called aqueous (pronounced AY-kwee-us) humor circulates inside the front portion of your eye. To maintain a constant healthy eye pressure, your eye continually produces a small amount of aqueous humor while an equal amount of this fluid flows out of your eye. If you have glaucoma, the aqueous humor does not flow out of the eye properly. Fluid pressure in the eye builds up and, over time, causes damage to the optic nerve fibers.

Glaucoma can cause blindness if it is left untreated. Only about half of the estimated three million Americans who have glaucoma are even aware that they have the condition. When glaucoma develops, usually you don't have any early symptoms and the disease progresses slowly. In this way, glaucoma can steal your sight very gradually. Fortunately, early detection and treatment (with glaucoma eyedrops, glaucoma surgery or both) can help preserve your vision.

There are several types of glaucoma:

- Open-angle glaucoma
- Normal-tension glaucoma
- Closed-angle glaucoma (or Narrow-angle glaucoma or Angle-closure glaucoma)
- Congenital glaucoma
- Secondary glaucoma

Open-angle glaucoma

The most common form of glaucoma is called primary open-angle glaucoma. It occurs when the trabecular meshwork of the eye gradually becomes less efficient at draining fluid. As this happens, your eye pressure, called intraocular pressure (IOP), rises. Raised eye pressure leads to damage of the optic nerve. Damage to the optic nerve can occur at different eye pressures among different patients. Your ophthalmologist (Eye M.D.) establishes a target eye pressure for you that he or she predicts will protect your optic nerve from further damage. Different patients have different target pressures.

Typically, open-angle glaucoma has no symptoms in its early stages and your vision remains normal. As the optic nerve becomes more damaged, blank spots begin to appear in your field of vision. You usually won't notice these blank spots in your day-to-day activities until the optic nerve is significantly damaged and these spots become large. If all the optic nerve fibers die, blindness results.

Half of patients with glaucoma do not have high eye pressure when first examined. Some such individuals will only occasionally have high eye pressures on repeat testing; thus, a single eye pressure test misses many with glaucoma. In addition to routine eye pressure testing, it is essential that the optic nerve be examined by an ophthalmologist for proper diagnosis.

Normal-tension glaucoma

Eye pressure is expressed in millimeters of mercury (mm Hg), the same unit of measurement used in weather barometers.

Although normal eye pressure is considered a measurement less than 21 mm Hg, this can be misleading. Some people have a type of glaucoma called normal-tension, or low-tension glaucoma. Their eye pressure is consistently below 21 mm Hg, but optic nerve damage and visual field loss still occur. People with normal-tension glaucoma typically receive the same methods of treatment used for open-angle glaucoma.

Conversely, ocular hypertension is a condition where someone has higher eye pressure than normal, but does not have other signs of glaucoma, such as optic nerve damage or blank spots that show up in their peripheral (side) vision when tested. Individuals with ocular hypertension are at higher risk for developing glaucoma later relative to those with lower, or average, eye pressure. Just like people with glaucoma, people with ocular hypertension need to be closely monitored by an ophthalmologist to ensure they receive appropriate treatment.

Closed-angle glaucoma, narrow-angle glaucoma or angle-closure glaucoma

A less common form of glaucoma is closed angle (or narrow-angle glaucoma or angle-closure glaucoma). Closed-angle glaucoma occurs when the drainage angle of the eye becomes blocked. Unlike open-angle glaucoma, eye pressure usually goes up very fast. The pressure rises because the iris — the colored part of the eye — partially or completely blocks off the drainage angle. People of Asian descent and those with hyperopia (farsightedness) tend to be more at risk for developing this form of glaucoma.

If the drainage angle becomes completely blocked, eye pressure rises quickly resulting in a closed-angle glaucoma attack. Symptoms of an attack include:

- Severe eye or brow pain
- Redness of the eye
- Decreased or blurred vision
- Seeing colored rainbows or halos
- Headache
- Nausea
- Vomiting

A closed-angle glaucoma attack is a medical emergency and must be treated immediately. Unfortunately, people at risk for developing closed-angle glaucoma often have few or no symptoms before the attack.

People at risk for closed-angle glaucoma should avoid over-the-counter decongestants and other medications where the packaging states not to use these products if you have glaucoma.

Congenital glaucoma

Congenital glaucoma is a rare type of glaucoma that develops in infants and young children and can be inherited. While uncommon relative to the other types of glaucoma, this condition can be devastating, often resulting in blindness when not diagnosed and treated early.

Secondary glaucoma

Secondary glaucoma is glaucoma that results from another eye condition or disease. For example, someone who has had an eye injury, someone who is on long-term steroid therapy or someone who has a tumor may develop secondary glaucoma.

Causes of Glaucoma

Glaucoma causes include elevated eye pressure (called intraocular pressure or IOP) due to the eye's inability to drain fluid efficiently.

A clear fluid called aqueous humor circulates inside the front portion of our eyes. To maintain a constant healthy eye pressure, the eye continually produces a small amount of aqueous humor while an equal amount of this fluid flows out of the eye. The fluid flows out through a very tiny drain called the trabecular meshwork, a complex network of cells and tissue in an area called the drainage angle.

If you have glaucoma, the aqueous humor does not flow through the trabecular meshwork properly. If the drainage angle is become less efficient at draining fluid, as in the common open-angle glaucoma, excess fluid cannot flow out of the eye properly, causing the intraocular pressure (IOP) to increase. Over time, raised IOP causes damage to the nerve fibers. If the drainage angle becomes completely blocked, eye pressure rises quickly, resulting in a narrow-angle glaucoma or angle-closure glaucoma attack, with severe eye and brow pain, nausea and vomiting. This kind of glaucoma attack is a medical emergency and must be treated immediately.

Damage to the optic nerve can occur at different eye pressures among different patients. Your ophthalmologist (Eye M.D.) establishes a target eye pressure for you that he or she predicts will protect your optic nerve from further damage. Different patients have different target pressures.

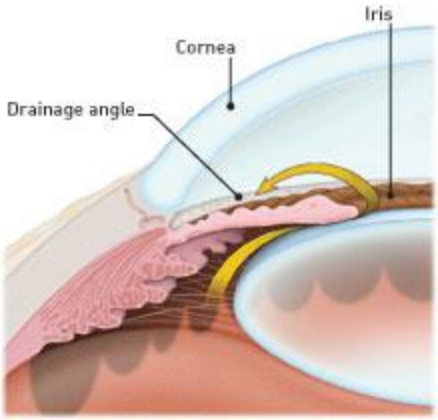
Some people have a type of glaucoma called normal tension, or low tension glaucoma. Their eye pressure is consistently below 21 mm Hg, but optic nerve damage and visual field loss still occur.

Congenital glaucoma is a rare type of glaucoma that develops in infants and young children. It can be hereditary, and it happens when the eye's drainage system doesn't develop fully or correctly before birth.

Glaucoma can often be caused by another eye condition or disease. This is known as secondary glaucoma. For example, someone who has a tumor or people undergoing long-term steroid therapy may develop secondary glaucoma. Other causes of secondary glaucoma include:

- Eye injury;
- Inflammation of the eye;
- Abnormal blood vessel formation from diabetes or retinal blood vessel blockage;
- Use of steroid-containing medications (pills, eyedrops, sprays); or
- Pigment dispersion, where tiny fragments or granules from the iris (the colored part of the eye) can circulate in the aqueous humor (the fluid within the front portion of the eye) and block the trabecular meshwork, the tiny drain for the eye's aqueous humor.

If you have received a glaucoma diagnosis from your Eye M.D., your doctor will talk about possible treatment options, such as glaucoma eyedrops and/or glaucoma surgery.



If the drainage angle is blocked, excess fluid cannot flow out of the eye, causing the fluid pressure to increase

Glaucoma Symptoms

Only about half of people who have glaucoma are even aware that they have the condition. When glaucoma develops, usually you don't have any early symptoms. In this way, glaucoma can steal your sight very gradually.

Symptoms of glaucoma

In its early stages, open-angle glaucoma has no obvious signs. As the disease progresses and more damage occurs, blind spots develop in your peripheral (side) vision. These spots may not be noticeable until the optic nerve has become severely damaged — or until detected by an ophthalmologist during a complete exam.

See a simulation of what vision with glaucoma looks like.

People at risk for closed-angle glaucoma (also called narrow-angle or angle-closure glaucoma), where the eye's drainage angle becomes blocked, usually have no symptoms before the attack, though some early symptoms can include blurred vision, halos, headache or mild eye pain or redness. At the time of a closed-angle glaucoma attack, symptoms include:

- Severe eye or brow pain
- Redness of the eye

- Decreased or blurred vision
- Seeing colored rainbows or halos
- Headache
- Nausea
- Vomiting

People with “normal-tension glaucoma” may have eye pressures within normal ranges, but have glaucoma signs and symptoms, such as blind spots in their field of vision and optic nerve damage.

Some people may not have glaucoma symptoms, but may have higher than normal eye pressure (called ocular hypertension). They are considered “glaucoma suspects,” and should be monitored carefully by an ophthalmologist.

Who Is at Risk for Glaucoma?

Some people are at greater risk for developing glaucoma and should see their ophthalmologist on a regular basis, specifically for glaucoma testing.

Risk factors for glaucoma include:

- Age
- Family history of glaucoma
- African or Hispanic ancestry
- Farsightedness or nearsightedness
- Elevated eye pressure
- Past eye injury
- Having a thinner central cornea (the clear, front part of the eye covering the pupil and colored iris)
- Not having eye examinations when they are recommended
- Conditions that affect blood flow, such as migraines, diabetes and low blood pressure

People of Asian descent and those with hyperopia (farsightedness) tend to be more at risk for narrow-angle glaucoma (also known as angle-closure glaucoma or closed-angle glaucoma).

If you have received a glaucoma diagnosis from your Eye M.D., your doctor will talk about possible treatment options, such as glaucoma eyedrops and/or glaucoma surgery.

Glaucoma Diagnosis

One of the problems with glaucoma, especially open-angle glaucoma, is that there are typically no symptoms in the early stages. Many people who have the disease do not know they have it. This is why it is important, especially as you get older, to have regular medical eye exams by an Eye M.D.

Glaucoma tests

Your ophthalmologist will do the following tests and exams during a comprehensive glaucoma evaluation:

Measure the pressure in your eye (tonometry)

Your doctor measures your eye pressure using tonometry. (See photo above) Testing your eye pressure is an important part of a glaucoma evaluation. A high pressure reading is often the first sign that you have glaucoma. During this test, your eye is numbed with eyedrops. Your doctor uses an instrument called a tonometer to measure eye pressure. The instrument measures how your cornea resists pressure. Normal eye pressure generally ranges between 10 and 21 mm Hg. However, people with normal-tension glaucoma can have damage to their optic nerve and visual field loss even though their eye pressure remains consistently lower than 21 mm Hg.

Inspect your eye's drainage angle (gonioscopy)

Gonioscopy allows your ophthalmologist to get a clear look at the drainage angle to determine the type of glaucoma you may have. Your ophthalmologist is not able to see your eye's drainage angle by looking at the front of your eye. However, by using a mirrored lens, he or she can examine the drainage angle to determine if you have open-angle glaucoma (where the drainage angle is not working efficiently enough), closed-angle glaucoma (where the drainage angle is at least partially blocked), or a dangerously narrow angle (where the iris is so close to the eye's drain that the iris could block it).

Inspect your optic nerve (ophthalmoscopy)

Your ophthalmologist inspects your optic nerve for signs of damage using an ophthalmoscope, an instrument that magnifies the interior of the eye. Your pupils will be dilated (widened) with eyedrops to allow your doctor a better view of your optic nerve.

A normal optic nerve is made up of more than one million tiny nerve fibers. As glaucoma damages the optic nerve, it causes the death of some of these nerve fibers. As a result, the appearance of the optic nerve changes. This is referred to as cupping. As the cupping increases, blank spots begin to develop in your field of vision.

Test your side, or peripheral, vision (visual field test)

The visual field test will check for blank spots in your vision. The results of the test show your ophthalmologist if and where blank spots appear in your field of vision — including spots you may not even notice.

The test is performed using a bowl-shaped instrument called a perimeter. When taking the test, a patch is temporarily placed on one of your eyes so that only one eye is tested at a time. You will be seated and asked to look straight ahead at a target. The computer makes a noise and random points of light will flash around the bowl-shaped perimeter, and you will be asked to press a button whenever you see a light. Not every noise is followed by a flash of light. Visual field testing is usually performed every 6 to 12 months to monitor for change.

Measure the thickness of your cornea — the clear window at the front of the eye (pachymetry)
Because the thickness of the cornea can affect eye pressure readings, pachymetry is used to measure corneal thickness. A probe called a pachymeter is gently placed on the cornea to measure its thickness.

Early detection and treatment can protect your vision.

People of any age with glaucoma symptoms or glaucoma risk factors, such as those with diabetes, a family history of glaucoma, or those of African descent, should see an ophthalmologist for an exam. Your ophthalmologist will let you know how often to return for follow-up exams.

Adults with no symptoms of or risk factors for eye disease should have a complete eye disease screening by age 40 — the time when early signs of disease and changes in vision may start to happen. Based on the results of the initial screening, your ophthalmologist will let you know how often to return for follow-up exams.

Adults 65 or older should have an eye exam every one to two years, or as recommended by your ophthalmologist.

Glaucoma Treatment

How your glaucoma is treated will depend on your specific type of glaucoma, the severity of your disease and how it responds to treatment.

Glaucoma medication

Medicated eyedrops are the most common way to treat glaucoma. These medications lower your eye pressure in one of two ways — either by slowing the production of aqueous humor or by improving the flow through the drainage angle.

These eyedrops must be taken every day. Just like any other medication, it is important to take your eyedrops regularly as prescribed by your ophthalmologist.

Never change or stop taking your medications without talking with your doctor. If you are about to run out of your medication, ask your doctor if you should have it refilled.

If you have glaucoma, it is important to tell your ophthalmologist about your other medical conditions and all other medications you currently take. Bring a list of your medications with you to your eye appointment. Also tell your primary care doctor and any other doctors caring for you what glaucoma medication you take.

Glaucoma surgery

In some patients with glaucoma, surgery is recommended. Glaucoma surgery improves the flow of fluid out of the eye, resulting in lower eye pressure.

Laser trabeculoplasty

A surgery called laser trabeculoplasty is often used to treat open-angle glaucoma. There are two types of trabeculoplasty surgery: argon laser trabeculoplasty (ALT) and selective laser trabeculoplasty (SLT).

During ALT surgery, a laser makes tiny, evenly spaced burns in the trabecular meshwork. The laser does not create new drainage holes, but rather stimulates the drain to function more efficiently.

With SLT, a low level energy laser targets specific cells in the mesh-like drainage channels using very short applications of light. The treatment has been shown to lower eye pressure at rates comparable to ALT.

Even if laser trabeculoplasty is successful, most patients continue taking glaucoma medications after surgery. For many, this surgery is not a permanent solution. Nearly half who receive this surgery develop increased eye pressure again within five years. Many people who have had a successful laser trabeculoplasty have a repeat treatment.

Laser trabeculoplasty can also be used as a first line of treatment for patients who are unwilling or unable to use glaucoma eyedrops.

Laser iridotomy

Laser iridotomy is recommended for treating people with closed-angle glaucoma and those with very narrow drainage angles. A laser creates a small hole about the size of a pinhead through the top part of the iris to improve the flow of aqueous fluid to the drainage angle.

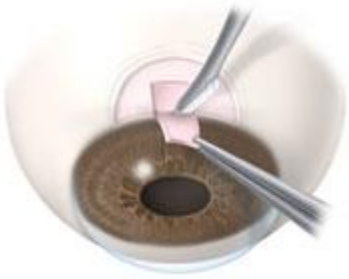
Peripheral iridectomy

When laser iridotomy is unable to stop an acute closed-angle glaucoma attack, or is not possible for other reasons, a peripheral iridectomy may be performed. Performed in an operating room, a small piece of the iris is removed, giving the aqueous fluid access to the drainage angle again. Because most cases of closed-angle glaucoma can be treated with glaucoma medications and laser iridotomy, peripheral iridectomy is rarely necessary.

Trabeculectomy

In trabeculectomy, a small flap is made in the sclera (the outer white coating of your eye). A filtration bleb, or reservoir, is created under the conjunctiva — the thin, filmy membrane that covers the white part of your eye. Once created, the bleb looks like a bump or blister on the white part of the eye above the iris, but the upper eyelid usually covers it. The aqueous humor can now drain through the flap made in the sclera and collect in the bleb, where the fluid will be absorbed into blood vessels around the eye.

Eye pressure is effectively controlled in three out of four people who have trabeculectomy. Although regular follow-up visits with your doctor are still necessary, many patients no longer need to use eyedrops. If the new drainage channel closes or too much fluid begins to drain from the eye, additional surgery may be needed.



In trabeculectomy, a flap is first created in the sclera (the white part of the eye). Then a small opening is made into the eye to release fluid from the eye.

Aqueous shunt surgery

If trabeculectomy cannot be performed, aqueous shunt surgery is usually successful in lowering eye pressure.

An aqueous shunt is a small plastic tube or valve connected on one end to a reservoir (a roundish or oval plate). The shunt is an artificial drainage device and is implanted in the eye through a tiny incision. The shunt redirects aqueous humor to an area beneath the conjunctiva (the thin membrane that covers the inside of your eyelids and the white part of your eye). The fluid is then absorbed into the blood vessels. When healed, the reservoir is not easily seen unless you look downward and lift your eyelid.

Important things to remember about glaucoma:

There are a number of ways to treat glaucoma. While some people may experience side effects from glaucoma medications or glaucoma surgery, the risks of side effects should always be balanced with the greater risk of leaving glaucoma untreated and losing vision.

If you have glaucoma, preserving your vision requires strong teamwork between you and your doctor. Your doctor can prescribe treatment, but it's important to do your part by following your treatment plan closely. Be sure to take your medications as prescribed and see your ophthalmologist regularly.

Does marijuana help treat glaucoma?

The main objective in treating glaucoma is to lower intraocular pressure (or "IOP") in the eye. A lower IOP can reduce damage to the optic nerve and save your remaining vision. Marijuana has been proven to lower IOP but only for a short period of time and at considerable risk to your overall health.

When marijuana is smoked or when the active ingredient is ingested in some other manner, the pressure-lowering effect within the eye can last from 3 to 4 hours. This period of time is too short, as glaucoma needs to be treated 24 hours a day. Additional drawbacks include the impaired functioning that results from smoking marijuana and the potential harmful effects of prolonged use.

The Academy does not recommend marijuana as a treatment for glaucoma. Considering the more effective treatments available to patients—from prescription medication to surgical procedures—the risks and side-effects of marijuana treatment far outweigh its modest short-term benefits, which do not properly control IOP.