



What You Need to Know About ...

Glaucoma

Sponsored by Alcon Laboratories, Inc.

What is glaucoma?

Glaucoma is the name given to a group of eye conditions that damage the optic nerve, which is the pathway between the eye and the brain. If left untreated, glaucoma leads to permanent vision loss and blindness. With early detection and treatment, however, you can often protect your eyes from serious vision loss. A diagnosis of glaucoma signals the beginning of an important, long-term partnership with your eye doctor. Carefully following your eye doctor's instructions will help preserve your vision.

What causes glaucoma?

Although an exact cause is unknown, glaucoma is most often associated with abnormally high pressure inside the eye. This pressure—called *intraocular pressure* or *IOP*—comes from a buildup of aqueous humor, which is the clear fluid that is produced continuously inside your eye. Usually, this fluid exits your eye through a drainage system at the angle where the iris (the colored part of the eye) and the cornea (the clear covering of the eye) meet (see *How Eye Pressure Builds up*). If the

drainage system does not work properly, the pressure within the eye increases and damages the optic nerve.

What are the symptoms of glaucoma?

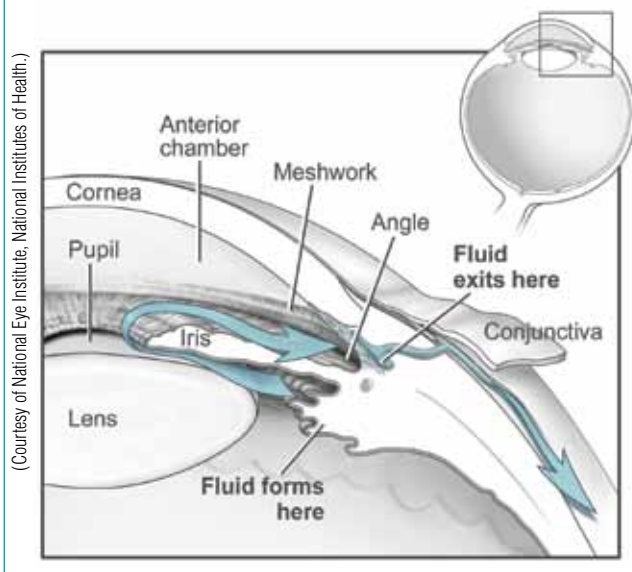
Glaucoma has been called the “silent thief of sight,” because the most common type, primary open-angle glaucoma, has no symptoms until it reaches an advanced stage when vision loss becomes apparent. Without treatment, people with glaucoma slowly lose their peripheral (side) vision until they seem to be looking through a tunnel. Over time, central vision may worsen until no



(Courtesy of National Eye Institute, National Institutes of Health.)

People with untreated glaucoma slowly lose their vision, starting in the periphery.

How Eye Pressure Builds up



In a normal eye, the fluid called *aqueous humor* exits the eye at the open angle where the cornea and the iris meet. When the fluid reaches the angle, it flows through a spongy meshwork and leaves the eye. In open-angle glaucoma, even though the drainage angle is open, the fluid passes too slowly through the meshwork drain. The fluid builds up, and the pressure inside the eye rises to a level that may damage the optic nerve. When the optic nerve is damaged by increased pressure, open-angle glaucoma—and vision loss—may occur.

vision remains. Anyone with risk factors for glaucoma should have regular comprehensive eye examinations by an eye care professional.

What are the risk factors for glaucoma?

Everyone is at risk for glaucoma, but some factors can increase your risk, such as:

- **High eye pressure**—Only an eye doctor can detect this during a comprehensive eye examination.
- **Age**—The older you are, the greater your risk for glaucoma is.
- **Race**—People of African descent have a higher risk for open-angle glaucoma than people of other races, and they are also more likely to have glaucoma at a younger age. People of Hispanic ancestry who are over the age of 60 also have a higher risk of open-angle glaucoma. People of Asian descent appear to be at increased risk for angle-closure glaucoma, and those of Japanese descent are at higher risk for normal-tension glaucoma. For more on the types of glaucoma, see page 4.
- **Family history of glaucoma.** Primary open-angle glaucoma is an inherited condition. If members of your immediate family have glaucoma, you are at a much higher risk than the rest of the population.

Some medical conditions, such as high blood pressure, poorly controlled diabetes, and underactive thyroid (hypothyroidism), may be associated with what is called *secondary glaucoma*. Steroid drugs used to treat eye inflammations and other diseases can trigger secondary glaucoma in some people.

Are there special tests for glaucoma?

Your eye doctor can detect glaucoma during a comprehensive dilated eye examination. During the examination, the doctor places drops in your eyes to widen (dilate) your pupils and then uses a special light and magnifying lens to examine the back of your eye and the optic nerve.

(Your near vision may remain blurred for several hours after the examination because of the drops.) Other diagnostic tests include:

- **Eye pressure (tonometry).** To take this reading, your eye doctor numbs your eyes with drops, then briefly touches the tonometer to the surface of each eye to measure the pressure. Another type of tonometer releases a warm puff of air on the eye's surface, which also provides a pressure reading. Normal eye pressure ranges from 12 to 22 millimeters of mercury (mm Hg). Each person's pressure is unique and may change throughout the day.
- **Visual field (perimetry).** This test measures your peripheral vision. You sit in front of a bowl-shaped machine and stare at a central spot while tiny flashes of light randomly appear around the inside of the bowl. You press a button whenever you see a light. A computer records the spots where the flashes occurred, and a printout shows if you did not see any flashes.



The visual field test shows your eye doctor how well you see in the periphery.

- **Gonioscopy.** This test helps determine if the angle where the iris meets the cornea is open or closed. After numbing your eye with drops, your doctor gently places a hand-held lens on the eye. This lens has a mirror that shows the angle. A closed angle is a possible sign of angle-closure or acute glaucoma. If you have other signs of glaucoma, an open angle could indicate chronic, open-angle glaucoma.

- **Corneal thickness (pachymetry).** Your doctor will want to know the thickness of your cornea because an unusually thin or thick cornea can affect the accuracy of eye pressure readings.

These are the most common tests used when glaucoma is suspected, but your eye doctor may use other instruments and tests to obtain as much information as possible before he or she reaches a final diagnosis and decides on a treatment plan.

Do people with high eye pressure always develop glaucoma?

Not always. Some people can tolerate higher-than-average eye pressures, and what is a high pressure for one person may be normal for someone else.

I have normal eye pressure. Does that mean I cannot get glaucoma?

People with normal eye pressures can develop a form of open-angle glaucoma called *low-tension* or *normal-tension* glaucoma.

Is there a cure for glaucoma?

Unfortunately, glaucoma cannot be cured or prevented, and vision lost because of glaucoma cannot be restored. Lowering eye pressure in the early stages of glaucoma may slow its progression and helps save vision. Depending on the type of glaucoma and if it is mild, moderate, or advanced, treatment may involve prescription medications—usually eye drops—or surgery or both.

How is glaucoma treated with eye drops?

The main goal of eye drops is to lower eye pressure. If your doctor prescribes eye drops for glaucoma, be sure to use them every day as prescribed.

Do glaucoma drops have side effects?

Most people have no serious problems with eye drops for glaucoma, but some drops can cause headaches or other side effects, such as red eyes or temporary burning or stinging. Many

WHAT ARE THE TYPES OF GLAUCOMA?

• **Primary open-angle glaucoma** is the most common form of glaucoma and accounts for 90% of all cases. With primary open-angle glaucoma, the clear fluid inside the eye (aqueous humor) does not flow out properly. This causes pressure inside the eye to build up, eventually damaging the optic nerve and affecting vision.

Other less common types of glaucoma include:

• **Acute angle-closure glaucoma** occurs when the flow of the aqueous humor is suddenly blocked. Symptoms may include severe eye pain, decreased or cloudy vision, nausea, and vomiting. *Acute angle-closure glaucoma is an emergency and requires immediate medical attention to prevent blindness.*

• **Chronic angle-closure glaucoma** may occur in people who have an abnormally narrow angle where the cornea and the iris meet (see the illustration on page 2) or when a normally sized angle narrows over time. The narrow angle interferes with the natural drainage process, causing eye pressure to build up.

• **Normal-tension glaucoma** is also called *low-tension* or *normal-pressure glaucoma*. With this type of glaucoma, the optic nerve is damaged even though the intraocular pressure is within normal limits.

• **Congenital glaucoma** is present at birth. It is caused by incorrect or incomplete development of the eye's drainage canals. This rare condition may be inherited and can often be corrected with surgery.

• **Secondary glaucoma** can be open-angle or closed-angle and is the result of some other medical condition in the eye or the body. Two examples of secondary glaucoma are pigmentary glaucoma, a rare form in which pigment granules from the iris flake off into the aqueous humor and clog the eye's drainage system, and pseudoexfoliation syndrome, which occurs when white material appears to flake off the lens of the eye and blocks the normal flow of the aqueous humor.

different types of eye drops are available to treat high eye pressure, so if you have problems with one medicine, your eye doctor may prescribe something else.

How long must I use eye drops for glaucoma?

Glaucoma is a chronic, incurable condition, so people with glaucoma must use their drops as long as they help control their eye pressure, sometimes for the rest of their lives. Because glaucoma has no symptoms, some people are tempted to stop using their drops, or they may forget to use them. This gives glaucoma a chance to get worse. Using your drops as prescribed is very important to control eye pressure and help prevent vision loss.

What if my glaucoma continues to progress?

If your high intraocular pressure cannot be controlled with medication, your doctor may recommend surgery.

How can surgery help glaucoma?

Surgery cannot reverse vision loss, but it can help lower eye pressure by improving the flow of fluid out of the eye when medication is not sufficient. Surgery may involve laser treatment, an incisional procedure called *filtration surgery*, or the insertion of a drainage tube. All of these methods are used to reduce intraocular pressure. The type of surgery your doctor recommends will depend on the type and severity of your glaucoma and the general health of your eye.

What are the most common laser surgeries to treat glaucoma?

The most common laser surgeries to treat primary open-angle glaucoma are argon laser trabeculoplasty (ALT) and selective laser trabeculoplasty (SLT).

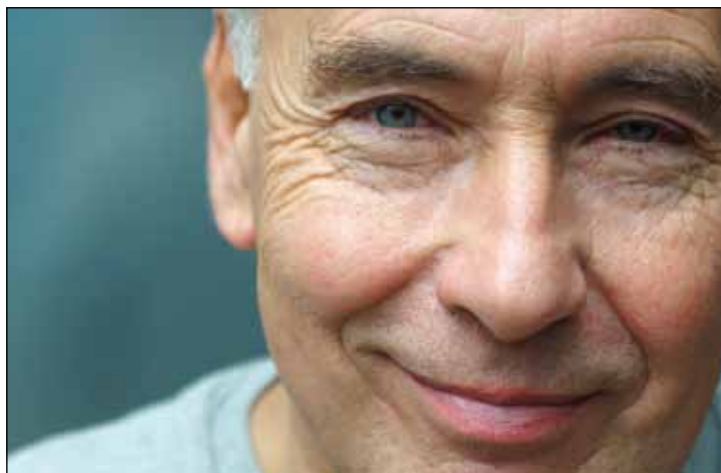
During ALT, a laser beam opens the fluid channels of the eye, helping the drainage system work better. SLT uses a laser that works at very low energy levels and selectively treats specific cells, while leaving untreated areas intact.

Even when laser trabeculoplasty is successful, most patients need to continue using eye drops to control and maintain normal eye pressures. Surgery may lessen the amount of medication needed.

People with angle-closure glaucoma or those who have very narrow drainage angles may have a procedure called *laser iridotomy*. During this procedure, the eye surgeon uses a laser to create a small hole about the size of a pinhead through the top of the iris to improve the flow of the fluid inside the eye to the drainage angle.

What does filtration surgery involve?

Filtration surgery, called *trabeculectomy*, is an outpatient procedure, which is generally indicated after failed medical therapy and laser surgery. It is usually performed using a local anesthetic and relaxing medications. An eye surgeon makes a small flap in the white part of the eye (sclera) and creates a reservoir, called a *bleb*, under the clear membrane (conjunctiva) that covers the sclera. The bleb looks like a bump or blister on the sclera. The aqueous humor drains through the flap and collects in the bleb, where it is absorbed into blood vessels around the eye.



Immediately after surgery, the operated eye will be red and irritated, and there may be increased tears. Generally, you should avoid getting water in the operated eye for 1 week and avoid driving, reading, bending, and heavy lifting. Every patient is different, however, so it's important to follow your surgeon's specific instructions.

What is recovery like after filtration surgery?

Recovery from trabeculectomy can take up to 8 weeks. During this time, vision will be blurry, and your surgeon will want to see you frequently, usually on a weekly basis, to check eye pressure and make adjustments to the flap to ensure that your eye pressure is not too high or too low. If the pressure remains too high, your doctor may prescribe IOP-lowering drops.

Are there complications with filtration surgery?

Trabeculectomy has been used safely to help control eye pressure for more than 40 years. As with any surgery, however, there may be complications. Some complications of trabeculectomy include lower-than-normal eye pressure, bleb leaks or failure (scar tissue grows over the opening), and, rarely, bleeding or infection.

My surgeon will use a drainage device for my trabeculectomy. What is that?

Many surgeons now implant an artificial drainage device instead of creating a hole. One such device is the EX-PRESS® Glaucoma Filtration Device (Alcon Laboratories Inc.). The EX-PRESS® Glaucoma Filtration Device is intended

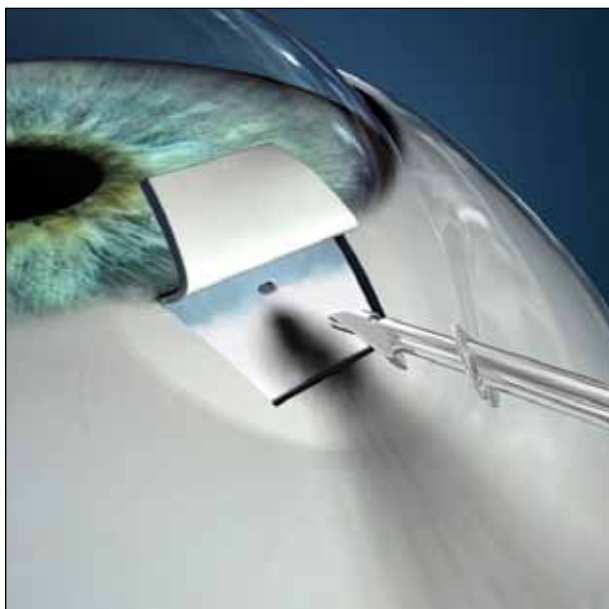
to reduce intraocular pressure in glaucoma patients where medical and conventional surgical treatments have failed. A filtration device has several advantages over traditional trabeculectomy:

- **Less invasive.** No tissue is removed.
- **More precise.** Fluid outflow is controlled by the exact size of the opening of the device and the scleral flap.
- **Fewer complications.** Researchers have found that a majority of patients who receive the EX-PRESS® device have fewer postoperative complications and need fewer glaucoma medications and glaucoma surgeries after receiving the implant than patients who have traditional trabeculectomy.¹⁻⁴
- **Quicker recovery.** Researchers have also found that patients who receive the EX-PRESS® device have a faster visual recovery and need fewer postoperative eye doctor visits than those who have traditional trabeculectomy.¹⁻⁴

Although the EX-PRESS® Glaucoma Filtration Device has been shown to reduce complications in filtration surgery when compared to trabeculectomy, as with any surgery, there are risks. Some potential device-related complications include obstruction, malfunction, extrusion, or erosion. In addition, any type of filtering surgery, including trabeculectomy or the implantation of the EX-PRESS® Glaucoma Filtration Device, carries the risk of hyphema, hypotony, choroidal effusion, or choroidal detachment. You should speak with your eye doctor about the potential benefits and risks of using the EX-PRESS® Glaucoma Filtration Device.



The EX-PRESS® Glaucoma Filtration Device is less than 3 millimeters long, about the size of a grain of rice.



With the EX-PRESS® Glaucoma Filtration Device, fluid outflow is controlled by the exact size of the opening of the device and the scleral flap.

Is there a treatment for people whose filtration surgery has failed?

People who have certain types of glaucoma, uncontrolled glaucoma, or failed filtration sur-

gery may undergo what is called *tube-shunt surgery*. There are several types of glaucoma tubes or shunts, but the surgery is similar regardless of the device used. The surgeon makes a small incision near the top of eye under the conjunctiva, inserts the body of the device, and sutures it in place. A drainage tube, which extends from the body of the device, is inserted into the front part of the eye.

REMEMBER ...

If you have glaucoma, preserving your vision requires teamwork between you and your eye 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 eye doctor regularly.

GLAUCOMA RESEARCH CONTINUES

Researchers around the world continue to study glaucoma. Their work encompasses every aspect of the disease, from the physical structure of the optic nerve and the mechanics of eye pressure control to the role of genetics in determining who develops the disease, all in the hope of finding more effective treatments and eventually a cure. For example,

- Researchers at Harvard Medical School have linked genetic mutations to normal-pressure glaucoma. This discovery could lead to the development of gene-based disease detection and treatment.⁵
- Researchers are studying new classes of IOP-lowering eye drops, new drug combinations, and new surgical devices and treatments.



Resources

American Academy of Ophthalmology

<http://www.geteyesmart.org/eyesmart/diseases/glaucoma>

American Glaucoma Society

<http://www.americanglaucomasociety.net>

American Health Assistance Foundation

<http://www.ahaf.org/glaucoma/>

American Optometric Association

<http://www.aoa.org/Glaucoma.xml>

Glaucoma Foundation

<http://www.glaucomafoundation.org>

Glaucoma Research Foundation

<http://www.glaucoma.org>

Lighthouse International

<http://www.lighthouse.org/about-low-vision-blindness/vision-disorders/glaucoma>

National Eye Institute of the National Institutes of Health

http://www.nei.nih.gov/health/glaucoma/glaucoma_facts.asp

Prevent Blindness America

<http://www.preventblindness.org/glaucoma>

References

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2. de Jong L, Lafuma A, Aguadé AS, Berdeaux G. Five-year extension of a clinical trial comparing the Ex-Press glaucoma filtration device and trabeculectomy in primary open-angle glaucoma. *Clin Ophthalmol*. 2011;5:527-533.
3. Good TJ, Kahook MY. Assessment of bleb morphologic features and postoperative outcomes after Ex-PRESS drainage device implantation versus trabeculectomy. *Am J Ophthalmol*. 2011;151:507-513.
4. Maris PJ Jr, Ishida K, Netland PA. Comparison of trabeculectomy with Ex-Press miniature glaucoma device implanted under scleral flap. *J Glaucoma*. 2007;16:14-19.
5. Burdon KP, Crawford A, Casson RJ, et al. Glaucoma risk alleles at CDKN2B-AS1 are associated with lower intraocular pressure, normal-tension glaucoma, and advanced glaucoma. *Ophthalmology*. 2012;119:1539-1545.

EX-PRESS® Device Important Safety Information

CAUTION: Federal law restricts this device to sale by or on the order of a physician.

INDICATION: The EX-PRESS® Glaucoma Filtration Device is intended to reduce intraocular pressure in glaucoma patients where medical and conventional surgical treatments have failed.

GUIDANCE REGARDING THE SELECTION OF THE APPROPRIATE VERSION: Prior clinical studies were not designed to compare between the various versions of the EX-PRESS® Glaucoma Filtration Device. The selection of the appropriate version is according to the doctor's discretion.

CONTRAINDICATIONS: The use of this device is contraindicated if one or more of the following conditions exist:

- Presence of ocular disease such as uveitis, ocular infection, severe dry eye, severe blepharitis.
- Pre-existing ocular or systemic pathology that, in the opinion of the surgeon, is likely to cause postoperative complications following implantation of the device.
- Patients diagnosed with angle-closure glaucoma.

WARNINGS/PRECAUTIONS:

- The surgeon should be familiar with the instructions for use.
- The integrity of the package should be examined prior to use and the device should not be used if the package is damaged and sterility is compromised.
- This device is for single use only.
- MRI of the head is permitted, however not recommended, in the first two weeks post implantation.

ATTENTION: Reference the Directions for Use labeling for a complete listing of indications, warnings, precautions, complications and adverse events.

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