

# **Glaucoma:** **Essential Facts**



**National Glaucoma Research**

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**The nonprofit BrightFocus Foundation is an international leader in supporting innovative research to find cures for Alzheimer’s disease, macular degeneration, and glaucoma. Guided by scientific review panels of world-class researchers, we invest in promising and rigorous science to end diseases of mind and sight. Through free publications such as this one, we share research findings and helpful tips with those impacted by these diseases, including families and caregivers.**

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**Glaucoma is not just one disease, but a group of eye diseases that damage the optic nerve—the bundle of nerve fibers that carry information from the eye to the brain. It can start without warning and lead to vision loss and blindness if left untreated. Currently, there is no cure for any type of glaucoma.**

More than 60 million people internationally have glaucoma, and it is a leading cause of blindness worldwide. In the U.S., an estimated 3 million people live with this disease, yet as many as half of them may not be aware that they have glaucoma.

The most common type of glaucoma often has no symptoms in the early stages. Because of this, regular eye exams are important, especially for people who are at high risk. (See “Are You at Risk?”).

Too often, by the time people notice that something is wrong with their vision, glaucoma already has damaged their optic nerve, causing permanent vision loss. Initially, there is a loss of peripheral (side) vision, and continued damage can lead to blindness.

Optic nerve cells do not regenerate, unlike many other cells in the body, and there is no way to replace them. Scientists are hopeful that someday it may be possible to restore sight lost to glaucoma. However, at the present time, vision loss is permanent.

There is good news, though. Once glaucoma is detected, medications and surgery can keep it from progressing in 90 percent of all cases. The earlier the diagnosis and treatment, the better, to preserve your sight.

### Are You at Risk?

Glaucoma can occur in anyone, at any age, but these factors increase the risk:

- African American or Hispanic ethnic background
- Family members with glaucoma
- Age 60+ years (40+ years if African American)
- Thin corneas
- Unusual appearance of optic nerve
- High intraocular pressure, or IOP
- Potential risk factors include severe nearsightedness, diabetes, eye injury, eye surgery, high blood pressure, and use of corticosteroids

### How Does Glaucoma Damage Sight?

To understand how glaucoma destroys vision, it is necessary to learn a little bit about how the eye works.

The eye makes a fluid called aqueous humor that circulates through the front of the eye to cleanse and nourish its tissues. When aqueous humor leaves the eye, it passes through an opening near the lens and drains through a spongy area called the trabecular meshwork.

Normally there is a balance between the amount of aqueous humor produced and the amount that leaves the eye. However, sometimes the eye does not drain properly, or there may be another problem that causes excess fluid to back up. When that happens, it can lead to an increase in intraocular pressure (IOP).

An IOP of more than 21 mm Hg is generally considered to be above normal. (Note: mm Hg is an abbreviation for millimeters of mercury and is a standard measurement of pressure.)

The increase in IOP—whether sudden and catastrophic, or gradually, over time—compresses the back of the eye, where a bundle of nerve fibers pass out of the eye and into the brain, and damages the delicate optic nerve tissue. First this happens to the outer layer, which carries signals for peripheral vision, and eventually to the inner layers that provide central vision. The loss of vision is gradual, starting with darkness at the edges, causing a tunnel-like effect that builds in size if left untreated.

The goal of most glaucoma treatment is to normalize pressure (IOP) in the eye, before

there is nerve damage. People at high risk, including those with one or more risk factors, and those who already have slightly elevated pressure, need to be monitored for signs that it's time to start treatment.

There are some types of glaucoma where damage can occur even for those with low or normal pressure. These types are far less common and may be treated differently.

## Types of Glaucoma and Their Symptoms

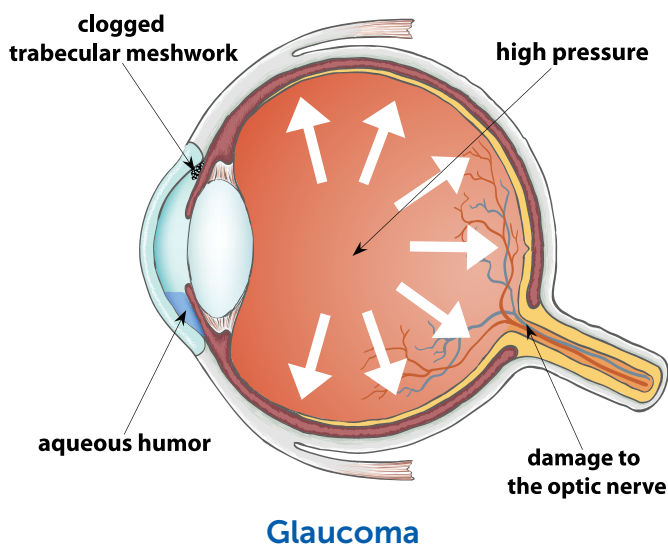
**Open-angle glaucoma** is the most common type and accounts for 70-90 percent of all cases. Often there are no noticeable symptoms at early stages, and high IOP is the most significant risk factor or indication that you are developing glaucoma.

This is a chronic, slowly-progressing condition. Many factors, including age, structural defects, damage to the trabecular meshwork and/or other drainage systems in the eye, aqueous humor overproduction, or blockages may be responsible for a rise in IOP.

Open-angle glaucoma is most common later in life, with genes, environment, and lifestyle all contributing. With age, the cells of the trabecular meshwork may not function as well as they used to, or may decline in number.

**Angle-closure glaucoma**, the next most common type, is a largely inherited disorder caused by a too-narrow angle in the passageway where aqueous fluid would normally drain. This type of glaucoma may occur in two ways:

- Acute angle-closure glaucoma begins suddenly when the normal flow of aqueous humor between the iris and lens is blocked. Symptoms include pain, nausea, vomiting,





blurred vision, and seeing halos around lights. This is a medical emergency requiring immediate treatment. Otherwise, blindness can result in one or two days.

- Chronic angle-closure glaucoma progresses more slowly and can damage the eye without symptoms, similar to open-angle glaucoma.

There are subtypes of both open-angle and closed-angle glaucoma.

**Normal (or “low”) tension glaucoma** is a type of open-angle glaucoma that damages the optic nerve and causes vision loss despite normal IOP. It may relate to poor blood flow within the optic nerve or ultrasensitivity to pressure, and sometimes is treated by lowering pressure.

**Congenital glaucoma** is an inherited condition affecting infants, who are born with angle-closure defects in the eye.

**Juvenile glaucoma** is open-angle glaucoma that affects children, adolescents and young adults.

**Secondary glaucoma** can be open-angle or closed-angle, and is the result of some other medical condition in the eye or the body. For example, **pigmentary glaucoma** and **pseudoexfoliation glaucoma**, are rare forms of glaucoma in which pigment granules from the iris or lens flake off into the aqueous humor and clog the trabecular meshwork; **neovascular glaucoma**, where abnormal blood vessel growth blocks drainage channels; and **iridocorneal endothelial syndrome (ICE)** where cells from the cornea break off and impede drainage.

## Screening and Diagnosis

Diagnosing glaucoma requires a comprehensive eye exam with dilation, performed by a qualified eye doctor (see “What Type of Doctor Should I See?” on page 6). The American Optometric Association recommends that most adults aged 18-60 years should have one every two years, and adults 61-and older should have one on a yearly basis. This is a good rule of thumb, but it is important to always follow your doctor’s recommendations—especially if you are at high risk for developing glaucoma.

When you arrive at the office or clinic for your exam, you will be given special eyedrops that temporarily enlarge the pupil. This is known as dilation. It permits a better view inside the eye, allowing the doctor to inspect the optic nerve for any signs of damage and check for corneal thinning, which is a glaucoma risk factor.

During your eye exam, an IOP measurement will be taken with a tonometer (also known as the “puff test” or “puff-of-air test”). Depending on the results of this and other tests, the doctor may recommend monitoring your eyes over time or beginning treatment.

Sometimes additional tests may be used to diagnose glaucoma and monitor its progression.

**Optic nerve imaging** records pictures of the optic nerve and is used to monitor changes over time.

**Visual field testing** is a computerized program that assesses your central and peripheral vision. Loss of peripheral vision is a sign of glaucoma.

A comprehensive eye exam also includes a **visual acuity test** to measure sight (corrected

and uncorrected) at various distances using an eye chart. This is not a glaucoma test, however, it is used to prescribe or update prescriptions for corrective lenses.

### What Type of Doctor Should I See?

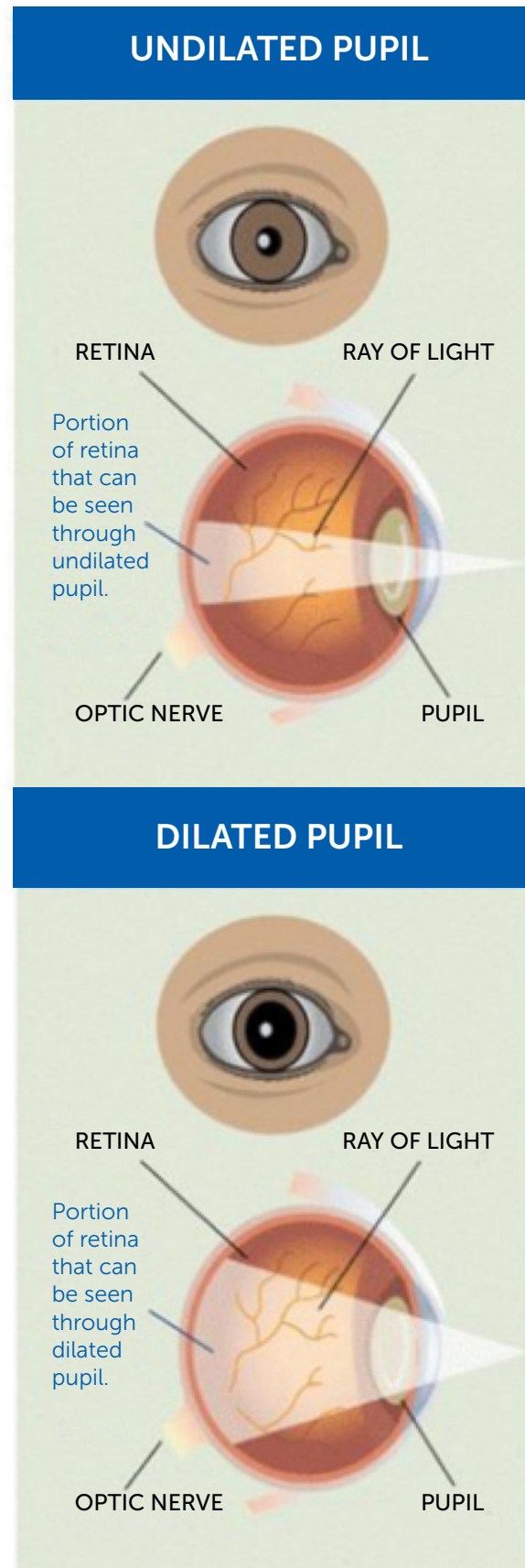
Ophthalmologists and optometrists can both perform dilated eye exams that are used to screen for glaucoma.

**Ophthalmologists** are board-certified physicians who have, at minimum, eight years of postgraduate training and are able to prescribe drugs and perform surgery. Some ophthalmologists pursue an additional year of fellowship training to specialize in glaucoma.

**Optometrists** are licensed practitioners who have four years of postgraduate training and in most states are licensed to prescribe medicine and perform some procedures for glaucoma. Optometrists also can pursue specialized training that makes them highly qualified to treat glaucoma.

Your choice of a doctor may depend on who is available in your area; whether you already have an eye doctor you feel comfortable with; and whether you have a late-stage or aggressive type of glaucoma that requires advanced treatment.

In addition to your eye doctor, you should assemble a team with additional expertise to help you manage glaucoma. For example, your team might include low-vision rehabilitation specialists, benefits managers, and community support groups, in addition to trusted friends and family members.



National Eye Institute, National Institutes of Health

## Essential Questions to Ask Your Doctor

### What kind of glaucoma do I have?

Because there are many types of glaucoma, the treatment recommendations vary depending on which type you have. Your doctor can review the pros and cons of your treatment options so that you can make an informed decision.

### Can you show me how to properly use my eyedrops?

Prescription eyedrops are a common glaucoma treatment, and it is important that you administer them correctly to have the maximum benefit. Your doctor can provide tips for how to properly use eyedrops so that they are most effective and side effects are reduced.

### What kinds of side effects can result from taking glaucoma medications?

Side effects vary by medication, so it is important to speak with your doctor about your specific drug options. Be sure to ask how they may interact with other

medications or supplements that you are taking.

### Should I be taking any special precautions at home?

Your doctor may suggest ways to improve lighting and make your home safer and more functional, or may refer you to experts who can help such as low-vision specialists, geriatricians, or occupational therapists. Ask about options for visual aids to help you with your daily activities. Check with your doctor about whether you need to modify your diet or avoid certain activities.

### Are you aware of any new information or research concerning glaucoma?

New research focuses on lowering pressure inside the eye and finding medications to protect and preserve the optic nerve from damage that causes vision loss. Scientists are also investigating the role of genetics in glaucoma.

Be sure to ask your doctor if he or she believes you would be a good candidate for any upcoming clinical trials.

## Common Treatments for Glaucoma

### Medication

Most types of glaucoma are treated first with medication, usually eyedrops (referred to as “ophthalmic solutions”) and, rarely, pills. Many people are able to control their condition with those alone.

Medications work by improving the flow of fluid out of the eye or decreasing eye fluid

production. Sometimes more than one type of glaucoma medication is combined. All medications have potential side effects, and you should discuss those with your doctor. It is never a good idea to stop taking a medication without your doctor’s advice.

### Surgery

Both laser surgery and conventional surgery are also effective at lowering eye pressure. Typically they are used to clear pathways in the trabecular meshwork or another part of the eye

so that better drainage is achieved. Sometimes surgery may be used to implant a device, such as a tube or a shunt, into the eye to create a new drainage channel. In some cases, surgical treatment may be combined with medication to lower IOP as much as needed.

Any surgery carries risks, and you will be informed of these. However, new techniques have made eye surgery much less invasive and quick to heal.

Discuss all treatment options—including benefits and side effects—with your eye doctor, to determine the best course of care for you. Remember that you are always entitled to seek a second opinion. For more information on the types of treatment available, see our publication *Glaucoma: Treatment Options*.

## Living Well with Glaucoma

Glaucoma is a chronic disease that has to be managed over a lifetime. Along with treatment to protect your vision, other adjustments may be needed to enable you to meet daily challenges and live independently.

### Medications, Nutrition, and Lifestyle

A top priority is to protect your eyes from further damage or vision loss. That means getting regular, comprehensive eye exams; consulting with your doctor about any changes in your eyes or vision; using your eye medication(s) consistently, as directed; and protecting your eyes from sun exposure with sunglasses that block ultraviolet rays.

Protecting your sight also means having a healthy lifestyle. Experts recommend that you try to maintain a healthy weight and normal blood pressure; control other medical conditions; don't smoke; limit caffeine intake;



## Paying for Glaucoma Care

Medicare and Veterans Administration benefits cover glaucoma treatments; however, if you are uninsured or worried about treatment costs, speak to your doctor or someone on their staff. They may consider using a less expensive or generic medication that is effective, or might refer you to local programs and organizations that can help.

BrightFocus has two Fact Sheets that can help. *Financial Aid for Glaucoma Medications* lists prescription assistance programs offered by pharmaceutical companies and other groups. *Glaucoma Resources for Patients and Caregivers* lists additional services to help people with glaucoma. Request these by calling our toll-free number, 1-855-345-6647.

In addition, state and local government programs can help you find affordable glaucoma care and low vision services. Check with your local Area Agency on Aging or call the National Association of Area Agencies on Aging at (202) 872-0888.

and get daily exercise with activities such as walking, swimming, or yardwork.

Nutrition also matters. You want your diet to be rich in antioxidants that help prevent and repair cell damage and fight inflammation. These nutrients have been found to nourish the eyes and promote vision:

**Vitamin A**, which occurs naturally in several different compounds. The most important of these for eye health are carotenoids, found in colorful fruits and vegetables. Lutein and zeaxanthin are carotenoids found in dark, leafy



greens such as spinach, collard greens, and fresh parsley; and in deep yellow and orange vegetables like pumpkin, squash, and corn.

**Vitamin C**, plentiful in red peppers, kale, strawberries, kiwi, broccoli, cauliflower, papaya, and citrus fruits.

**Vitamin E**, found in vegetable oils, wheat germ, fortified cereals, milk fats (including butter), nuts and seeds, leafy greens, and seafood and meat.

**Zinc**, consumed from nuts, bran, whole grains, mushrooms, legumes (e.g., beans and peas), lean meats (especially beef, pork, and lamb), eggs, peanuts, and cheese.



### Organizing Your Home

Accidents and falls are a serious concern for people with low vision. It is important to maximize lighting; clear passageways; and use contrasting colors and shades to help you “navigate” your world. Here are some tips to get started.

- Mark the edges of steps with tape or paint them with contrasting colors; install handrails.
- Keep “travel areas” clear of furniture and eliminate anything you might trip over, such as throw rugs and clutter.

- Tape the edges of surfaces like sinks and tubs, appliances, and furniture to distinguish them from their surroundings.
- Mark light switches, electrical outlets, and thermostat.
- Also mark your medicine with colored tape, rubber bands, and large-print labels; and set alarms to remind you to take them.
- Organize household items logically and always put things back in the same place.
- Make use of low-vision aids with large letters and numbers, including: clocks, watches, telephones, remote controls, books, magazines, puzzles, and computers.
- Program frequently used and emergency numbers into your telephone.

### Meeting Everyday Challenges

Becoming informed is key to coping with glaucoma. Learn all you can about your disease.

Take an honest look at your home, your lifestyle, and your responsibilities, and think about whether you can cope, need help, or might be better off modifying or eliminating a particular demand. This includes work and volunteer activities; transportation; and activities of independent living, such as cooking, cleaning, grocery shopping, bathing, and doing your own laundry.

Some tasks may become easier with improved lighting or low-vision aids. It may help to reach out to professionals, such as low vision specialists, occupational therapists, and geriatric specialists and aides, who can evaluate your situation and help you devise strategies.

For tasks you can no longer perform, solutions exist. Can you carpool to your activities? Ask a friend to take you shopping? Hire someone for

chores that are too difficult? Contact charities and community volunteer organizations for help?

If there are issues to deal with, such as employment, housing, and health benefits, you can find a wealth of information on the BrightFocus website ([www.brightfocus.org/glaucoma](http://www.brightfocus.org/glaucoma)). Or call our toll-free number, 1-855-345-6647, for more information.

### About driving

While many people with glaucoma continue to drive, it can mean extra challenges. You may be susceptible to glare and eye fatigue, and may find it difficult to spot pedestrians and vehicles, read road signs, and navigate poorly marked roads and neighborhoods.

For your own safety and that of others, recognize your limitations and adjust accordingly. For example, you might limit your driving to daylight hours and arrange rides or use public transportation for evening events. If you are traveling long distances, you could share the driving and break up the trip with overnight stops.

At a certain point, your age or your glaucoma may convince you it is time to stop driving. There are experts who can help you make this decision. Learn more from the BrightFocus brochure, *Safety and the Older Driver*, which you can order by calling 1-855-345-6647.

### Finding More Help

Finding out that you have glaucoma can be a big adjustment. It calls upon you to make changes in order to stay independent and protect your health. This can be a stressful time, and it is not advisable to try and “go it alone.”

Don't be afraid to ask for help and let others know your wants and needs. Eye doctors,

low vision therapists, family, friends, and community volunteers can all be a tremendous support.

Consider joining a glaucoma or low-vision support group. If you have some vision loss, seek out companies and organizations that offer low vision aids and print and audio materials at little or no cost. Some of these resources are listed below, and you'll find much more information here: [www.brightfocus.org/ngrrsources](http://www.brightfocus.org/ngrrsources).

As you begin to cope, try to focus on the essentials and do not get overwhelmed thinking about the “what ifs.” Resolve to take on challenges as they arise, and ask for help in finding the right solutions.

Over time, you will learn the best ways to manage your glaucoma and lead a full and happy life.

## More Information

**National Glaucoma Research (NGR)**, a BrightFocus Foundation program, supports glaucoma research worldwide and has a strong commitment to providing informational tools to those impacted by the disease.

NGR offers many free publications, which can be ordered by phone or by mail. Most of our resources are available in both English and Spanish. In addition, our website, [www.brightfocus.org](http://www.brightfocus.org), offers an online Disease Toolkit which includes resources for:

- Healthy Living
- Understanding Your Disease
- Managing Your Disease
- Living with Your Disease
- Caring for Someone Else



BrightFocus is at the forefront of brain and eye health, supporting innovative research around the world and promoting better health through our three programs:

**Alzheimer's Disease Research**  
**Macular Degeneration**  
**Research National Glaucoma**  
**Research**

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