

Glaucoma - A patient guide

What is glaucoma? Key facts

- Glaucoma is the name given to eye conditions in which damage occurs to the optic nerve related to the pressure inside the eye.
- Your optic nerve connects your eye to the part of the brain which controls your sense of vision.
- Damage occurs when the pressure within the eye is high enough to affect the health of the optic nerve, which cannot then carry the full vision signal.
- This usually begins as loss of the outer part (periphery) of vision and, if left untreated, can progress to tunnel vision and eventually loss of central vision.
- Once vision is lost it cannot be recovered.
- With early detection and treatment, most people have good vision for life.

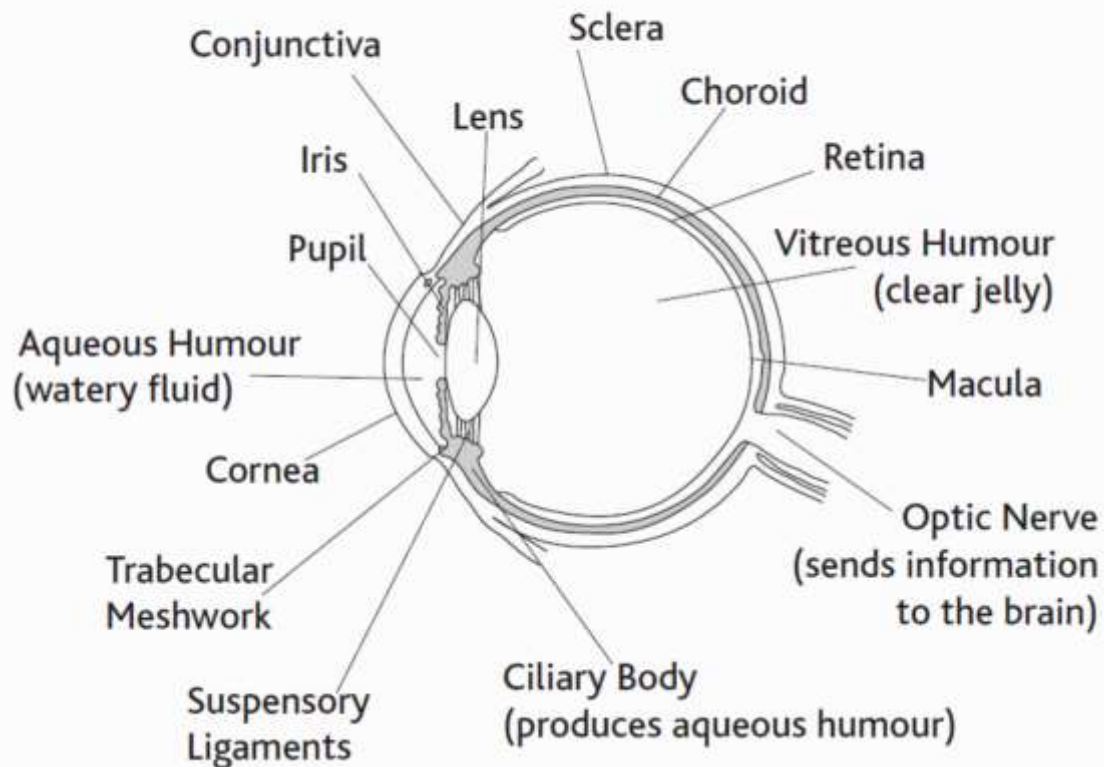
Understanding the eye

The eye is a hollow ball made of firm fibrous tissue which is mainly white (sclera) with a clear window (cornea) at the front to let in light. Inside the eye are the iris (coloured part) with a gap (pupil) in the middle to let in light. Behind the iris is the clear lens which focuses light onto the retina. The retina is a thin nerve layer lining the back of the eye which converts the light from the image you see into a pattern of electrical signals.

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Nerve fibres from the retina join together to form the optic nerve which takes these signals from the eye to the brain. The brain processes the impulses to generate the image you see. The part of the optic nerve that lies inside the eye is often called the optic disc. It has a little gap or hollow in the middle, called the “cup”, surrounded by a rim containing all the nerve fibres.

Cross section through the eye showing the major structures



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The hollow part of the eye in front of the lens is filled with a watery fluid called the aqueous humor. There is a constant flow of aqueous humor, as it is produced behind the iris, flows through the pupil and drains out again via a small space between the edge of the iris and edge of the cornea, known as the “angle” of the eye. Within this space there is spongy tissue called the trabecular meshwork through which the fluid trickles out. The pressure inside the eye is created by how much fluid is inside the eye, which is determined by the balance of aqueous entering the eye and draining out from the eye.

How is the eye affected by glaucoma?

Glaucoma occurs when the pressure in the eye (intraocular pressure, IOP) is too high for the nerve of sight to remain healthy. Exactly how pressure damages the nerve is not completely understood – it may be because the pressure reduces the flow of blood in the nerve or due to damage direct to the nerve tissue. The normal range of eye pressure is 6-21. However, some people are more sensitive to pressure than others. For some, typical glaucoma damage occurs at a relatively low eye

pressure; for others the pressure can be quite high and yet no damage is done – this is called ocular hypertension.

Where the eye pressure does rise above normal, this is usually because the drainage of fluid out of the eye is reduced and too much fluid builds up inside the eye.

As the nerve starts to be affected, nerve fibres start to die off in the rim of the optic disc and the hollow area or cup in the middle gets bigger. This appearance is known as “cupping”.

How common is glaucoma?

- Glaucoma is one of the leading causes of preventable blindness.
- It is estimated that 600,000 people in the UK have glaucoma, with half of those undiagnosed.
- It affects two per cent of people over the age of 40, and this rises to five per cent of people over the age of 80.

Risk factors and causes

Why do people get glaucoma?

We do not totally understand why. There are certain risk factors as described below which make glaucoma more likely. Generally, important factors seem to include: small differences in people’s genetic make up; things that affect the drainage area which change the ability of the fluid to escape out of the eye; things that reduce health blood supply in the nerve making it more sensitive to pressure.

Age: Glaucoma is uncommon below the age of 40 but becomes much more common with increasing age.

Family history of glaucoma;

- There is at least a four times increased risk of developing glaucoma if you have a close blood relative with the condition (father, mother, brother, sister, or child).
- •People with close relatives should get tested by their optician and this will be free so, if you have glaucoma, don’t forget to tell your relatives about the condition and the need for them to be tested.

Blood pressure

- People with very low blood pressure have a greater risk of worsening of glaucomatous sight loss.
- The eye doctor may want to check if any blood pressure treatment you are on might be lower the blood pressure too much.

Ethnicity

- People of African-Caribbean origin have about a four times increased risk of POAG when compared with those of a European origin and the condition also tends to come on at an earlier age and be more severe.
- People of Asian origin are at an increased risk of developing angle closure glaucoma.

Glasses prescriptions

- People with short sight (myopia) are at increased risk of developing glaucoma.
- Long sighted (hypermetropia) people are known to be at increased risk of developing angle closure.

Diabetes

People with diabetes are at increased risk of developing glaucoma, although it is not known whether there is a direct link between the two conditions.

People at high risk should be tested and can have the checks done by their optician for free*:

- Over the age of 60
- Diabetic
- Over 40 and have a close relative with glaucoma
- Advised by an ophthalmologist that you are at risk of glaucoma

It is wise for everyone over the age of 40 to have regularly checks at their optician to pick up conditions such as glaucoma.

How is glaucoma identified?

Glaucoma has no obvious symptoms in the early stages. It is usually painless and vision loss occurs slowly and unnoticed until it is quite advanced. Although patches of vision are lost, they are off centre and often, at first, one eye can fill in the gaps for the other eye. If it is not treated it can eventually lead to severe or even total loss of vision. But, if found and treated early, the outlook is very good.

For most people, glaucoma is picked up by their optician (optometrist) at a routine sight test.

There are three main tests:

1. Looking at the appearance of the optic nerve in the eye (the optic disc), checking for cupping. This can be done by looking at the eye with a special torch (ophthalmoscope), on the slit lamp (specialist eye examination microscope), by eye photographs or by scans of the eye (OCT, HRT).
2. Measuring the pressure in the eye (tonometry). This is ideally done on the slit lamp as this is the most accurate method, but it can also be done with other instruments including a puff of air or a hand held instrument.
3. Checking the field of vision (visual field test, perimetry). This maps out any blank or weak spots in the vision including at the edge of your vision.

.Other important tests for people who have or are suspected to have glaucoma include:

- Central corneal thickness – thick corneas can cause the pressure to seem artificially high and it helps interpret the significance of a high or low pressure.
- Gonioscopy; looking at the angle inside the eye with a special lens.

Some people have an optic disc cup shape that looks similar to early change in glaucoma but without any changes in the visual field. This optic disc appearance can be normal for them, as the optic nerve shape varies in different people. These people are often referred to as

glaucoma suspects as it can initially be difficult to determine whether or not they have glaucoma.

Types of glaucoma

Glaucoma can be divided into four main types.

1. Primary open angle glaucoma (POAG) aka chronic open angle glaucoma (COAG)

This is the most common type of glaucoma. It is a very slowly progressing disease and it is usually painless.

It is called open angle because the angle inside the eye containing the drainage area for fluid looks open when the eye is examined. It is presumed that the spongy tissue inside is blocked or not working properly to allow the fluid to escape

In some people, open angle glaucoma has a pressure in the normal range but they develop the typical optic nerve and visual field changes of glaucoma - this is known as normal tension glaucoma or low tension glaucoma.

2. Angle closure glaucoma (ACG)

This is less common and is due to a narrow angle, that is, there is not much space between the edge of the iris and the cornea, which makes it harder for the fluid to escape. This is seen in people who have smaller than average eyeballs, such as people who are quite long sighted or those with Oriental heritage and is more common in women.

For some patients, if glaucoma develops, it affects them in exactly the same way as POAG, with a slowly progressive condition which is painless and not noticeable in the early stages. This is called Chronic Narrow Angle Glaucoma or Chronic Primary Angle Closure Glaucoma.

For a small number of patients with narrow angles, the pressure can suddenly build up to a high level very quickly, called Acute Glaucoma or Acute Angle Closure Glaucoma. This is more common as people get older, as the lens of the eye grows bigger with age and can make the

angle more and more narrow, until suddenly the fluid drainage stops completely and the pressure shoots up.

This is a very painful and serious condition. The sudden change causes the clear cornea to cloud over, causing sudden blurring of vision, rainbow or halo effects around lights, a red painful eye and often vomiting. The optic nerve can be damaged very quickly and emergency treatment is needed. If treated rapidly the vision will recover but, if there is delay, permanent serious vision damage can occur. Treatment consists of drops, often also intravenous and medication by mouth, and laser treatment to prevent any further attacks.

Sometimes people experience a series of mild or partial attacks of angle closure. These are called 'sub-acute attacks' and often occur in the evening. Vision may seem misty, with coloured rings around white lights and there may be some discomfort and redness in the eye. If this is spotted, preventative laser treatment can be given to prevent a full attack of acute glaucoma.

3. Secondary glaucoma

This is glaucoma caused by another disease in the eye, that is, secondary to another eye problem. The glaucoma can be open angle or closed angle, depending on the cause. The list of causes is very long, including after an eye injury or after surgery, conditions such as diabetic eye disease or eye inflammation or even due to certain eye medications. Once the pressure has been lowered further treatment may be required to treat the underlying cause.

4. Congenital glaucoma aka developmental glaucoma

This is a rare form of glaucoma that is present at birth and is caused by a failure of the development of the angle inside the eye. It is present in about one in 10,000 babies and may be associated with other developmental abnormalities of the eye.

Glaucoma suspects and ocular hypertension

Because optic discs can look cupped but can be normal, because visual field testing can be difficult for some patients to perform at first, and because some can have a high pressure but no damage (ocular hypertension), for some people the diagnosis of whether or not they have glaucoma is not certain at first.

In these cases, your eye care professionals will use detailed testing, optic nerve scans, visual field test to help decide - and will make a plan with you for any longer term monitoring you need to see if anything changes. Some patients will progress to definite glaucoma, many will be able to be reassured and sent back to their optician for annual monitoring after several checks.

How is glaucoma treated?

The overall aim of glaucoma treatment is to lower the intraocular pressure to a level where the optic nerve is not being damaged. This can be achieved in several different ways: drops, tablets, laser, surgery. Most people are treated with drops. If drops are not working, cannot lower the pressure enough, or cannot be tolerated, patients may need laser or surgery. Some particular kinds of glaucoma are more likely to benefit from laser or surgery earlier, such as narrow angle glaucoma. More recently, laser and operations or in some cataract operations are beginning to be used at an earlier stage in the disease as technology develops.

Because different people are sensitive to different levels of pressure, often doctors will agree with you a “target pressure” for your own eye condition to protect the nerve. This is particularly important in normal tension glaucoma or advanced glaucoma.

Unfortunately there is no treatment currently available which can reverse sight loss due to glaucoma. For most people, glaucoma requires lifelong treatment and regular checks. Because the vision cannot be regained once lost, treatment is preventative and it is very important to continue using your treatment as prescribed even if you have no symptoms or cannot tell that it is helping your eyes. It is also important to know that drops can have side effects. Always read the information leaflet that

comes with the drop and ask your eye care professional what symptoms to look out for and what to do if you think you have side effects.

Drops to treat glaucoma

There are many different drops available to treat glaucoma and many patients will require a combination of different drops in order to reduce their eye pressure to a satisfactory level. There are 5 main types of drops to treat glaucoma:

1. Prostaglandin based drops e.g. Travatan (Travoprost), Xalatan (Latanoprost), Lumigan (Bimatoprost), Saflutan (Tafluprost), Monoprost (Latanoprost)

For most patients these are the first type of drop used. They work by increasing the amount of fluid leaving the eye.

Possible side effects:

- Redness or irritation in first few weeks – should get better
- Can cause stinging for a short while
- Eye lashes may grow longer, darker and thicker
- Some notice a change in iris colour over time. This is permanent
- Darkening of skin around the eye
- Headaches
- Shortness of breath – uncommon
- Skin rash - uncommon

2. B-blockers e.g. Timoptol, Tiopex (Timolol), Betagan (Levobunolol), Betoptic (Betaxolol), Teoptic (Carteolol)

Reduce the amount of fluid produced by the eye.

Possible side-effects:

- Main side effect is wheezing. People with asthma **should not** be given this type of drop
- Stinging, redness or irritation in first few weeks - should get better
- Skin rash
- Dry eyes - uncommon
- Tiredness
- Depression

- Loss of libido or impotence
- Very slow pulse rate, dizziness or reduction in exercise tolerance

3. Carbonic anhydrase inhibitors e.g. Azopt (Brimonidolide), Trusopt (Dorzolomide)

Reduce the amount of fluid produced by the eye

Possible side effects:

- Stinging, redness, or irritation in first few weeks – should get better
- Blurred vision and a bitter taste straight after putting in drops – should go away after a few minutes
- Headaches, dizziness, nausea – uncommon
- Indigestion, dry mouth – uncommon
- Shortness of breath – uncommon
- Eyelid irritation and red eye

4. Adrenergic agonists e.g. Alphagan (Brimonidine), Iopidine (Apraclonidine)

Reduce the production of fluid and increase the drainage of fluid out of the eye.

Possible side-effects:

- Headaches
- Stinging, redness or irritation in first few weeks – should get better
- Dry mouth, taste changes, dizziness, tiredness – uncommon
- Allergic reaction can happen after long, successful use – red, puffy eyes and irritation or itching

5. Parasympathomimetics e.g Pilocarpine

Increase the drainage of fluid out of the eye.

Possible side-effects:

- Makes pupil size smaller – almost always
- Headache
- Blurred vision
- Dim vision (especially in darkened places)

There are also now increasing types of combination drops with more than one type of drug in them that can be more convenient for patients.

Many patients find it difficult to put drops in their eyes to begin with, however there are many different techniques that can be used. Further advice on how to use drops can be found in our separate leaflet **How to use eye drops and ointment**.

Tablets to treat glaucoma

Some patients may require tablets to treat glaucoma if drops alone are not enough. Often tablets will be needed just for a short period of time.

The most common tablet used to treat glaucoma is called diamox (acetazolamide) which works by reducing the production of aqueous fluid.

Possible side effects:

- Tingling of hand and feet
- Tiredness
- Stomach upset or nausea
- More frequent passing of urine
- Altered level of blood salts

Laser to treat glaucoma

As previously discussed patient with acute glaucoma usually require laser treatment, and chronic narrow or closed angle glaucoma may require laser treatment, to lower their eye pressure. In this treatment, laser iridotomy, a small opening is created in the iris which pushes the iris back and opens the angle to allow fluid to escape.

Laser trabeculoplasty is another type of laser treatment used to treat open angle glaucoma. Laser spots are applied to the trabecular meshwork to stimulate the flow of fluid out of the eye.

These treatments can be done in the eye clinic and are generally painless and quick. All laser treatment carries a small risk of complications.

Surgery to treat glaucoma

Different types of operations are available to treat glaucoma, all of them have then same purpose: to reduce the intraocular pressure.

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Trabeculectomy: This is the most common operation. In a trabeculectomy, the surgeon makes a flap valve from the natural eye membranes over a small hole in the outer wall of the eye. This creates a new passage for the fluid to leave the eye, and the area where the fluid leaves can be seen as a small bump or blister under the upper lid, called a trabeculectomy 'bleb'.

Aqueous shunt or tube: these are devices that are used to reduce the intraocular eye pressure (IOP) by draining the fluid from inside the eye to a small blister or bleb behind the eyelid. Instead of forming a valve with the tissue of the eye, an artificial or plastic drain and valve are placed into the eye. Although there are many types of shunt available, two brands are in common use today, called the Ahmed Glaucoma Valve and the Baerveldt Aqueous Shunt Glaucoma Implant.

MIGS (minimally invasive glaucoma surgery): This is the name given to a range of different small implants which can be placed into the eye to lower eye pressure and reduce the need for eye drop medications. Some are used in the same way as trabeculectomy once other treatments have failed; others are starting to be used to replace drops in suitable patients, and some are best combined with cataract surgery. This is a rapidly developing area.

Other tips for keeping healthy eyes and a healthy attitude

Keeping generally healthy may help lower pressure and protect vision for example:

- Exercise for 20 minutes 3-4 times per week
- Avoid smoking
- Keep diabetes and high blood pressure well treated
- Have a healthy well balanced diet:
 - Vitamin B1 & B12 and antioxidants may help protect the nerve
 - Inuits who have a diet that includes fresh water fish, cod, salmon, tuna, sardines (rich in omega 3 oils) shown to have low rates of open angle glaucoma
 - Gingko Biloba may help optic nerve blood flow
- Be careful with other medications:

- **Steroids** - taken by mouth or inhalation, low risk of increasing pressure
- **Cold and flu remedies** – packet may state ‘avoid if you have glaucoma’. Contains a drug (pseudoephedrine) which causes slight pupil dilation – only need to be concerned if you have narrow drainage angles
- **Emotional feelings**
 - Share your fears and feelings
 - Talk with others who have glaucoma
 - Avoid stress
 - Find information and patient support groups
 - Family, friends and carers, can help support you or even help with treatment

Outlook for glaucoma

With early diagnosis, regular monitoring and treatment used properly, most people will retain useful sight for life. The earlier glaucoma is identified, the more likely it is that vision will remain normal

With very grateful thanks to the IGA (International glaucoma Association, Manchester Royal Eye Hospital, Moorfields eye Hospital)