What is Glaucoma?

Glaucoma is a disease of the optic nerve which is usually associated with high pressure inside the eye. In order to understand glaucoma it is important to understand how the eye works.

The eye is similar to a camera. The pupil is like the aperture of the camera, regulating the amount of light entering the eye. The cornea is the clear window of the eye and helps focus the light. The lens of the eye is located behind the pupil and also helps to focus the light. The lens is normally clear. Clouding of the lens is called a cataract. The light sensitive part of the eye is the retina, a thin layer of tissue lining the back of the eye. It is like the film or sensor in the camera. When light hits the retina a picture is taken. The optic nerve has the important role of sending the picture from the eye to the brain. This is how we see.

The optic nerve is like a video camera cable with many small wires, called optic nerve fibres. There are approximately one million nerve fibres within the optic nerve. These nerve fibres carry information about our detailed, central vision as well as our peripheral, or side vision. Central and peripheral vision together make up the visual field. The optic nerve fibres are very delicate and can be damaged by high pressure inside the eye.
What causes Glaucoma?

The front part of the inside of the eye is filled with a clear fluid called aqueous humor. This fluid is continuously produced and constantly flows out of the eye, maintaining a constant pressure. If the fluid fails to flow out of the eye properly, the eye pressure will increase in the same manner that holding one’s finger over the end of a hose causes the pressure in the hose to rise. The area where fluid leaves the eye is called the drainage angle.

Cross section of eye showing the location of the drainage angle (shown in the inset). High eye pressure can damage the optic nerve.

Arrows show the normal flow of fluid in the eye. Blockage of fluid flow causes eye pressure to rise.
What are the different types of Glaucoma?

**Primary or Chronic Open Angle Glaucoma**

This is the most common glaucoma (two thirds of cases). The drainage angle of the eye appears to be open, but it does not function properly and pressure within the eye gradually increases. Primary open angle glaucoma damages vision gradually and is painless, so most people are not aware that they have the condition until it is far advanced.

**Angle Closure Glaucoma**

Sometimes the drainage angle of the eye may become narrow and close gradually (chronic angle closure) or close suddenly (acute angle closure).

Acute angle closure glaucoma causes severe sudden pressure rise and is typically painful with the development of redness, blurred vision, haloes around lights, headaches and sometimes nausea and vomiting.

Chronic angle closure (one third of cases) leads to gradual pressure rise very like open angle glaucoma, but may not respond so well to standard drops. To maximise treatment success, it is most important to keep the angle open.

Series of images showing progressive change in the optic nerve head.
Who is at risk for Glaucoma?

Age increases a person's risk. The chance of having glaucoma is 0.5% at 45 years of age and 2% at 70 years of age.

A family history with either a parent, brother, sister or other direct relative with glaucoma increases the risk up to six times.

Past injuries to the eyes may cause damage to the drainage angle with resulting glaucoma sometimes occurring years later.

Other eye diseases may cause glaucoma.

Near-sighted or myopic patients have a slightly higher risk of developing glaucoma.

High eye pressure is an important risk factor. The usual eye pressure (intraocular pressure) is between 8 and 20 millimetres of mercury (mmHg). If you have an intraocular pressure over 25mmHg, the risk of developing glaucoma over the next 5 years is ten times greater.

High blood pressure is only weakly directly related to high eye pressure.
What are the symptoms of Glaucoma?

Raised eye pressure cannot be felt by the patient unless it quickly becomes markedly elevated, as in acute angle closure glaucoma. Therefore, most patients are unaware they have glaucoma.

Abnormal fluid flow within the eye cannot be seen on the outside of the eye and is not related to the flow of tears. Loss of vision occurs late in the disease after many optic nerves have already been damaged. Peripheral vision is initially affected and some people may be aware of golf or tennis balls disappearing out of view in an abnormal manner. Most people will not be aware of peripheral fluid loss until it is extensive and they have difficulty navigating around objects and through doorways. Other late symptoms include a change in colour vision, inability to adapt to different light levels and lastly difficulty reading and discerning fine details.

The symptoms of acute angle closure glaucoma include pain and redness in the eye, headaches, seeing haloes around lights, blurred vision, nausea and vomiting.
How is Glaucoma detected?

Regular eye examinations are the best way to detect glaucoma. During a complete exam your ophthalmologist:

- Will measure the fluid pressure of the eye (Tonometry)
- May examine the drainage angle of the eye (Gonioscopy)
- May test the visual field of each eye (Perimetry), and
- Will examine the optic nerve head (Ophthalmoscopy), photography, scanning laser tomography, and examine the nerve fibre layer

The appearance of the optic nerve is recorded either with a drawing, photographs or optic nerve head imagery device, enabling comparison at future examinations. The visual field test takes approximately 20 – 45 minutes and requires you to respond to small lights shown in different parts of the visual field.

The test can be tiresome, but it provides important information about the functioning of the optic nerve. It is the most sensitive test that we have; however, 30-50% of nerve fibres are lost before we can detect a change. Eye drops may be given to dilate (enlarge) the pupils, providing a better view for your ophthalmologist. These take approximately 30 minutes to take affect. Driving is not recommended for at least one hour after the examination.
How is Glaucoma treated?

Treatment is commenced or altered when deterioration in either the visual field or the optic nerve is detected. Because we know that patients with eye pressures greater than 30mmHg (millimetres of mercury) have a much higher risk of developing glaucoma, we often start treatment without waiting for deterioration in either the visual field or optic nerve. Some patients may not need immediate treatment, but they need to be followed more closely, either because of risk factors or examination findings which make them more likely to develop glaucoma. These patients are called glaucoma suspects.

Because damage to the optic nerve can not be reversed, treatment is aimed at preventing or slowing down further damage. The pressure is lowered to a level regarded as safe for a particular patient. This level is generally between 10-20mmHg. In more severe glaucoma a lower pressure is required to prevent further damage.

Patients need to be followed regularly while on treatment because over time treatment changes may be required.

Medicines

Eye drops

Eye drops lower the intraocular pressure by either decreasing fluid production or increasing fluid outflow through the drainage angle. They must be used regularly and continuously. The effect of a medication only lasts a certain amount of hours after which time the eye pressure may rise resulting in damage to the optic nerve. Therefore a number of drops used at specific intervals will be required.
Eye drops may have side effects in some patients and may aggravate some medical conditions. Tell your ophthalmologist if you suffer from breathing problems including asthma, or from heart disease, depression, kidney stones or allergy to sulphur drugs. Most drops sting when first put in the eye, some more than others. This is normal. The effectiveness of drops may be increased and side effects minimised by blocking the tear ducts after putting the drop in. This is done by applying gentle pressure over the inside corner of the eyes, next to the nose, while closing your eyes for five minutes after each drop. A patient on more than one drop should wait five minutes between drops to allow time for their absorption.

- Timolol and Betaxolol work in the same way to lower eye pressure but Betaxolol has less effect on the lungs and heart. Notify your ophthalmologist immediately if you notice a change in pulse, heart beat, or breathing while taking these drops.
- Prostaglandins (Xalatan/Travatan/Lumigan) all work by increasing the flow of fluid out of the eye. They can make the eyes red and itchy, darken the eye colour and make longer eyelashes.
- Alphagan/Iopidine reduce the fluid the eye makes. They can produce an allergic conjunctivitis.
- Azopt and Trusopt lower eye pressure by decreasing the production of fluid in the eye.

**Oral Medication**

Diamox is an oral medication used to lower intraocular pressure. These lower the eye pressure effectively, but make some people experience stomach upset, loss of appetite, drowsiness, tingling of fingers and toes, and bowel irregularities. Infrequent side effects include kidney stones and rashes.
Laser Surgery

Laser surgery is a painless procedure preformed as an outpatient. Local anaesthetic eyedrops are given and a special instrument is placed on the surface of the eye to hold the eyelids open and to provide a clear view for the surgeon. It is effective in different types of glaucoma. In Open Angle Glaucoma the drainage angle is treated directly (Trabeculoplasty). The effect lasts for an average of three years in 60% of patients. Most patients will still need to use eyedrops or pills. In Angle Closure Glaucoma the laser is used to make a tiny hole in the iris (Iridotomy) to prevent or halt an angle closure attack. This procedure improves flow of fluid to the drainage angle. Laser surgery has minimal side effect. Occasionally the eye may become inflamed or there may be an increase in the eye pressure immediately after the laser treatment. Your ophthalmologist may give you specific drops to use after the procedure. Should you notice pain, redness or blurred vision, report immediately to your ophthalmologist. Rarely, an irritation of the surface of the eye may occur which requires wearing of an eye patch for several days.

Cyclodiode Laser is a new laser which directly damages the fluid producing portion of the eye. It is useful in refractory cases of glaucoma and eyes with poor visual potential. 50% of patients will require more than one treatment.
Surgery

The commonest operation is a Trabeculectomy which creates a new drainage channel for fluid to leave the eye. This is done in the operating theatre using an operating microscope. Local anaesthetic is usually used, but occasionally a general anaesthetic may be preferred. Patients usually leave the hospital on the day of surgery and are followed up closely in the office after the operation. The surgery works well in 90% of cases.

The most common cause of failure is closure of the new channel from scar tissue formation. Special chemical agents can be used by injections after the surgery to slow the scarring process. A more complicated procedure may be needed in a small number of patients who develop excessive scarring or after previously failed surgery. Here a drainage tube is used.

In glaucoma surgery a new opening is made for the fluid to flow out of the eye. A small flap of tissue provides protection for the opening. A thin membrane of tissue called the conjunctiva covers the opening and flap after surgery.
Glaucoma surgery is generally quite safe, but as with any eye operation there is a small risk of infection or haemorrhage which can result in loss of vision or loss of the eye. It should be noted that the aim of the surgery is only to lower the eye pressure. It does NOT improve vision.

The rate of fluid flow through the new channel can vary during the first six weeks after the operation. Some patients will have fluctuating eye pressures which can affect their vision. Sometimes the eye pressure becomes too low, a condition called hypotony. This may induce swelling at the back of the eye. In most cases, the hypotony and swelling go away after six weeks and the vision improves, but in some cases the vision may be permanently damaged.

Trabeculectomy may hasten the development of a cataract, particularly if hypotony develops. Cataract surgery may then be needed or recommended before trabeculectomy.
Outcome

Glaucoma is the second commonest cause of blindness in our community. The best treatment can usually stop vision loss, or at least slow it down so much that the vast majority of patients will maintain good vision throughout their lives.

Community screening for Glaucoma

Throughout the Lions Save-Sight Foundation we have been extensively involved for many years in community screening projects for glaucoma. Since 1965, half a million people have been screened in every corner of the state. Screening examinations take less than five minutes. The program has been carried out without government subsidy and similar programs are in place for diabetic retinopathy and amblyopia. For more information contact your local Lions Club or the Save-Sight Foundation at the Lions Eye Institute.
Glaucoma research at the Lions Eye Institute

The clinical staff that you have met at the Lions Eye Institute represent only a small fraction of the people working in this institution. The Lions Eye Institute has both clinical and research components. It is the leading ophthalmic research institution in the southern hemisphere and is among the best in the world, ensuring that our patients receive the best and most up-to-date treatment. Glaucoma is the second commonest case of blindness. At the McCusker Glaucoma Centre many existing projects are underway to learn more about the causes of glaucoma and to develop new methods of detection and treatment.

The research that is done at the Lions Eye Institute is funded privately through donations and bequests as well as national and international research grants. All of the monies donated to the Institute goes toward research. Please join us in the fight against blindness. If you would like more information about the research activities at the Lions Eye Institute or would like to make a donation or a bequest, please contact the development office on the number on the facing page.
It takes sophisticated surgery to cure blindness

Glaucoma surgery is just one of the sophisticated procedures developed in fighting blindness, but the most difficult operation the Lions Eye Institute faces is getting the funds to continue its research. Research that relies upon the financial support of the community for its continued existence. Join us in the fight against blindness. Your tax deductible* donation is therefore a welcome and important contribution to an enterprise from which you or your loved-ones may one day benefit.

Please telephone (08) 9381 0777 for more information.

*Donations $2 or more are tax deductible.
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