



North Shore Eye Centre

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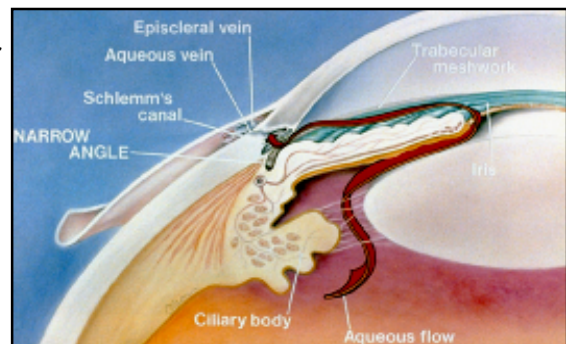
NEOVASCULAR (RUBEOTIC) GLAUCOMA

Background Information

A healthy eye sees as light enters the eye and is focused by the lens onto the back of the eye, the **retina**, creating a sharp image. When the image is transmitted to the brain by the **optic nerve**, the image is interpreted and vision occurs.

Blood travels through the optic nerve in arteries to reach the retina, and is normally drained away out of the eye in veins.

The front part of the eye consists of a clear watery fluid called the **aqueous fluid**. The aqueous is produced in the middle part of the eye (the **ciliary body**) and flows through the pupil, to the front part. It leaves the eye through a drainage system called the **trabecular meshwork**, as it flows out of the eye through veins and into the blood stream. The flow and drainage of this fluid can be obstructed in many ways.



What is Neovascular Glaucoma?

Neovascular Glaucoma is a serious condition, which is characterised by the growth of new blood vessels and a secondary increase in eye pressure.

Normally, the eye receives an essential supply of blood and nutrients which are delivered through the arteries. Any blockage of the arteries and/or an obstruction to the drainage of blood from the eye through its veins may lead to damage to the eye. This may occur if small blood vessels within the eye are affected due to diseases such as uncontrolled diabetes, high blood pressure, high cholesterol, or from smoking.

When the blood vessels to the eye are blocked, the structures in the eye do not have a sufficient supply of nourishment and oxygen. In response, the eye produces chemicals which stimulate the growth of tiny new blood vessels in the eye (a process known as neovascularisation). The new blood vessels grow along the surface of the retina, however the chemicals can seep to the front of the eye and cause neovascularisation in the front of the eye on the iris and in the trabecular meshwork.



Fig. 1
Assessment of the eye with a slit-lamp microscope.

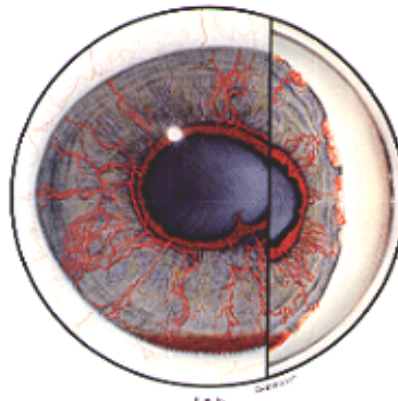


Fig. 2
Advanced Neovascular Glaucoma with large red vessels.

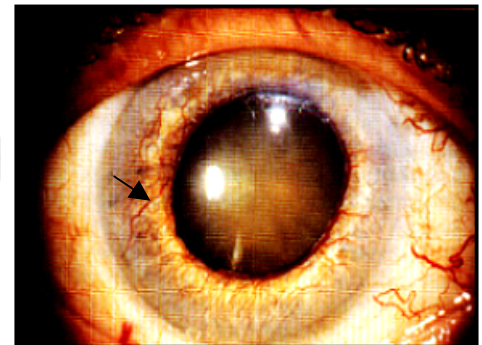


Fig. 3
Severe Neovascular Glaucoma.

These vessels are abnormally weak. In the back of the eye, haemorrhage and retinal detachment may develop causing damage and destroying vision in the affected eye. In the front of the eye these abnormal blood vessels can also disrupt the structure and function of the eye by blocking the drainage mechanism so the aqueous fluid cannot flow out of the eye.

The wall of the eye is not able to expand much, therefore this leads to elevation of the pressure in the eye. Raised pressure in the eye can cause damage to the optic nerve, which carries messages of sight from the eye to the brain, and can result in blindness.

Who Is At Risk For Developing Neovascular Glaucoma?

The clear aqueous fluid can only be properly formed if there is an adequate blood supply. Neovascular glaucoma occurs in individuals who have poor blood flow to the eye.

For example, in patients with diabetes, blood flow is often reduced in many parts of the body, including the eyes. Patients with long-standing diabetes (about 10 years or more) who have **proliferative retinopathy** are at a high risk of also developing

neovascular glaucoma. Another term for this is rubeotic glaucoma because of the rubeotic (red blood vessels) that grow onto the iris.

Other factors include impaired blood flow to the eye when the main blood vessels supplying the entire head are obstructed due to the aging process, and a sudden blockage of a blood vessel within the eye by a blood clot. This commonly occurs when the person has high blood pressure, raised cholesterol or smokes cigarettes.

How is Neovascular Glaucoma Treated?

Therapy for neovascular glaucoma is usually rather difficult; therefore management is aimed at detecting and diagnosing those that are at risk of developing neovascular glaucoma as soon as the condition develops, and preventing further development of neovascular glaucoma. The condition must be treated immediately in order to preserve the remaining sight, to prevent any further damage and to avoid the risk of pain, inflammation and blindness.

Treatment must be directed to the underlying cause. Any areas of the retina, which have been damaged by a vein blockage, should be identified and treated with laser to prevent the stimulation of more abnormal vessels. Once as much of the underlying cause has been managed, the level of remaining vision will usually give an indication of the type of treatment necessary for the glaucoma. If the laser treatment has been successful, the abnormal vessels will stop growing, the trabecular meshwork will open and improve the drainage mechanism, leading to a decrease in the eye pressure and preventing subsequent progression of glaucoma. If the treatment is partially successful, the blood vessels will stop growing, however the trabecular meshwork may remain obstructed by scar tissue.

Treatment is much more difficult after the development of neovascular glaucoma. The conservative treatment of glaucoma with anti-glaucoma eye drops and surgical procedures are usually ineffective in the treatment of neovascular glaucoma, especially when the drainage system has been destroyed.

Medical Therapy

Eye pressure must be reduced immediately to prevent further damage to the optic nerve. Drops (e.g. timolol or betagan) and tablets (diamox) may be useful in reducing the pressure. Also, other drops may help at the beginning to reduce inflammation and pain. These include the use of steroid eye drops (e.g. Pred Forte or maxidex) and drops to dilate the pupil and reduce any ocular congestion (e.g. atropine). In general, these drops are only for short-term use (i.e. a few months) as they have many side effects if used for longer periods. If the vision is poor, drops used to reduce any pain and discomfort in the eye may be continued for an indefinite period.

Laser Treatment

Laser is an effective form of treatment, which is used to destroy the structures in the retina, if they are poorly nourished because of a previously blocked blood vessel. This will eliminate the production of chemicals that stimulate the growth of new vessels in the front of the eye and preserve part of the trabecular meshwork and maintain consistent drainage of aqueous fluid.

Surgical Treatment

Glaucoma surgery may be attempted, however there is a high failure rate of conventional procedures. However, surgery may be considered if the neovascularisation continues and the eye pressure remains high with the use of eye drops and tablets. This is considered for the drainage of aqueous for those that still have the potential for sight.

Trabeculectomy is a form of drainage surgery, which creates a new drainage channel for the aqueous to flow through.

Valve implant surgery is another method of treatment and is usually indicated when trabeculectomy surgery fails.

Further Reference

Kanski, J.J. **Clinical Ophthalmology: A Systemic Approach**. 5th Ed. (2003) Butterworth Heinemann.