

Glaucoma Drainage Devices (Aqueous shunts)

What are Glaucoma Drainage Devices (Aqueous shunts) and what do they do?

Glaucoma Drainage Devices (Aqueous shunts) are devices that are used to reduce the eye pressure in glaucoma by draining the fluid from inside the eye to a small pool or *bleb* just under the eye surface hidden by the eyelid (see Figure 1). By draining the eye fluid out through the device, it reduces the pressure on the optic nerve and prevents further damage and further loss of vision from glaucoma.

The aim of the operation is to preserve your remaining vision. It will not improve your vision. Control of the eye pressure with an aqueous shunt will not bring back vision already lost from glaucoma.

There are many types of aqueous shunts available and two are in common use today and they function in a similar manner. They are called the *Ahmed Glaucoma Valve* and the *Baerveldt Glaucoma Implant*.

These shunts are made up of a small silicone tube (less than 1 mm in diameter) attached to a plate. The tube drains the fluid from inside the eye and drains it to the plate which sits on the white wall of the eye (sclera). The plate sits under the superficial skin of the eye (conjunctiva), under the eyelid.

The *Ahmed Glaucoma Valve* has a valve that helps to prevent very low eye pressure during the first few weeks after surgery.

The *Baerveldt* implant does not contain valves but have other advantages such as slightly lower eye pressure control for a longer duration.

Because the *Baerveldt* implants have no valve, they must be blocked with a stitch that is either tied around the outside of the silicone tube and/or threaded through the inside of the tube at the time of surgery. The purpose of the stitches is to prevent the it from draining too much in the first few weeks after surgery and causing the eye pressure to be too low. The stitches will be removed several weeks to months after the operation, depending on the eye pressure. This can be done on the slit lamp or by laser; both in the eye clinic. Sometimes, this might need to be performed in theatre if the position of the stitch does not have easy access.

How will my eye look?

In the early period after surgery the eye will be red and swollen to a variable degree. The eyelid will also droop partially. This resolves over a period of weeks to months. The aqueous shunt itself is not normally visible on the outside of the eye.

The drained fluid accumulates in a pool or *bleb* under the conjunctiva. The plate and its bleb are positioned far back behind the eyelid so they cannot usually be seen. The fluid is slowly absorbed by the blood vessels on the eye surface. If the eyelid has been lifted up, the shunt or bleb can be seen in when the eye is looking very far down.

Most shunts are implanted behind the upper eyelid. Sometimes other areas are used, such as below the lower eyelid.

A patch made of donor tissue, either from pericardium (heart lining) or fascia latta (tendon tissue) is used to cover the shunt and prevent it from exposure. This is the only part of the operation that might be visible after surgery and can be seen as a white rectangular patch on top of the eye ball.

The tube of the shunt is very small and cannot be seen with the naked eye. The tube itself is made of transparent silicone and usually sits 1-2 mm inside the top of the eye.

Medication prior to surgery

Prior to undergoing surgery, please continue all drops and tablets in accordance with your normal treatment regimen until the morning of the operation. Blood thinning medications such as Aspirin, Warfarin and Clopidogrel should also be continued. If you take Warfarin, please check your INR level at least 1 week prior to surgery to ensure it is within the correct therapeutic range.

If you are having a general anaesthetic, a preoperative assessment of your general health will be carried out just before surgery. Medical conditions like heart disease, uncontrolled high blood pressure or diabetes will need to be addressed before scheduling surgery. The surgery itself may last one to two hours.

Aqueous shunt insertion is often performed under general anaesthesia, although local anaesthesia with sedation is also possible under certain circumstances.

If your surgery is under local anaesthesia you will be awake during the operation. The eye will be numbed first with eye drops and then an injection of anaesthetic will be given under the eye. The anaesthetic injection may cause a sensation of pressure as it is delivered. This numbs the eye, preventing not only pain but also eye movement during surgery. You will still have sensation of your eye lids as this is not numbed.

During surgery, your face will be covered by a sterile sheet, or drape, which keeps the operation site sterile. You will be aware of the surgeon working around the eye, but should not feel pain. The nurse will hold your hand so that in the event of any pain or discomfort, you can squeeze the nurse's hand. The surgeon will stop the surgery and top-up the anaesthetic if needed. You may also hear the surgeon speaking to the scrub nurse and other members of the surgical team.

Mitomycin C

During the surgery, Mitomycin C may be applied to the surface of the eye for a brief period of time (5 minutes). Mitomycin C is a drug that was originally used to treat cancer, but it is also used in glaucoma surgery to reduce scarring. Scarring stops the trabeculectomy from working in the long term, as it prevents the fluid from flowing out of the trap-door. The Mitomycin C is then washed away from the eye with sterile water so that no residual drug remains.

Donor patch

A patch made from tissue from a commercial source (pericardium or fascia latta) is used to prevent break down of the surface tissue over the shunt. If donor tissue is not used, breakdown of the conjunctival surface of the eye over the implant can occur in 10-14% of cases. When donor tissue is used the risk of breakdown is less than 3%.

The donor tissues used in aqueous shunt surgery are not live transplants. They are used to reinforce the eye surface on the outside of the shunt. These tissues do come from donors and are therefore tested to ensure that they cannot transmit certain infectious diseases such as Syphilis, Hepatitis B and C and HIV (the AIDS virus). They are not, as yet, tested for prion disease (Bovine Spongiform Encephalopathy or BSE, otherwise known as mad cow disease or v-CJD) as no suitable test exists. The risk of transmission of prion disease at present appears to be extremely low.

After receiving donor tissue, patients are no longer eligible to donate blood in the United Kingdom.

After surgery

Patients are usually discharged home from hospital either the same day or the day after. All patients need to be examined on the day after surgery or the next day.

The eye is normally padded after surgery and the eye pad is removed the following day. If the unoperated eye does not see well, then the operated eye will not be padded. Instead, a clear shield will be placed on the operated eye so that it is still possible to see after surgery.

You should ask a friend or relative to accompany you home after surgery, especially if you have poor sight in the unoperated eye or if you have had a general anaesthetic.

Post operative Care

Eye drops are very important to prevent scarring and infection. These start the day after surgery. It is not necessary to use eye drops the first night after the surgery. Acetazolamide (Diamox) tablets or any glaucoma medication to the operated eye should be stopped the night after surgery.

It is important that any eye drops for the unoperated eye are continued unless advised otherwise.

The postoperative eye drops will usually consist of an antibiotic (eg. *chloramphenicol*) and anti-inflammatory steroid (eg. *dexamethasone*). The steroid eye drop will initially be used intensively (every 2 hours or about 8 times daily) and the antibiotic four times daily. These are intended to be taken during the day only.

You will be given a supply of postoperative eye drops on leaving the hospital which should last one month. The postoperative eye drops will need to be taken for 3 months.

You will be advised at each post-operative visit whether a change in the dosage of drops is required. Please ask for a prescription for more drops from the doctor when you run out. Do not stop or change the dosage without consulting the doctor.

Patients are usually seen once a week for the first 4 weeks, and may be seen more frequently if the eye pressure is either too high or too low.

High Pressure after surgery:

In some cases, the occluding suture may cause high pressure after surgery. This can be cut using a laser 2-3 weeks after surgery. This procedure is very quick, painless and is performed in the eye clinic. The occluding suture inside the tube can usually be removed after 3 months. The occluding suture can sometimes be removed in clinic but can require a return to the operating theatre to have it removed as a short operation. Please note that these sutures play part of a staged lowering of eye pressure in the eye. They protect the eye from the effects of low pressure in the first few weeks after surgery so if the pressure is high in the first weeks after surgery this does not mean that the shunt has not worked, but that the shunt is not working yet. It is normal for the shunt to start working after the ligature or occluding suture has been removed.

Low Pressure after surgery:

Sometimes the pressure is too low after surgery and this can sometimes be dangerous. Although very low pressure is often painless, it may be associated with a dull aching feeling or a throbbing sensation in the operated eye.

Low pressure, is detected during clinic appointments and is often treated by stopping any pressure-lowering eye drops and reducing steroid eye drops. Sometimes an injection of a jelly material (viscoelastic) is required to raise the pressure. Occasionally, a further operation is needed to reduce the drainage from the tube.

Activity after Surgery

It is very important to avoid strenuous activity during the early post-operative period including weight lifting, swimming, tennis, jogging and contact sports.

You can watch television and read, as these will not harm the eye. For patients who wish to pray, it is better to kneel but do not to bow the head down to the floor in the first 2 – 3 weeks. Bending over can cause significant pain when the eye is still inflamed after surgery. Activities such as yoga that require head-down posturing should be avoided.

As you will be monitored closely following surgery, you can consult your surgeon before starting any strenuous activity. If the eye pressure is very low after surgery the surgeon may suggest refraining from all exertion and resting until the pressure is restored.

When can I go back to work?

The duration of time off work will depend on factors such as the nature of your work, the vision in the other eye and the pressure in the operated eye.

Typically someone working in an office environment would require 2 weeks off, if the postoperative course is smooth. Someone whose does heavy manual work or work in a dusty environment may require a month or more (e.g. construction workers, farmers).

Contact lens wear after aqueous shunt implantation

It is usually possible to restart contact lens wear around 4 weeks and sometimes sooner after aqueous shunt implantation.

Flying after surgery

Although it is safe to fly after surgery, you should bear in mind your surgeon will wish to see you for frequent monitoring to ensure that the eye pressure is at the correct level.

When is the eye back to normal?

In most cases, it takes 2 to 3 months for the eye to feel completely normal and sometimes longer in more complicated cases. A spectacle test I can be performed after 3 months as the spectacle prescription may have changed slightly from the pre-surgery prescription.

Success rates

Most glaucoma surgical studies examine success rates over a 5 year period. With aqueous shunts such as the *Baerveldt*, the expected success rate over 5 years is now between 70 and 80%[1]. Although a proportion of patients do not need glaucoma medication, many will require some medication.

The number of medication required is usually less than before the surgery; In one recent study using the *Baerveldt* implant, after 5 years the average patient achieved a pressure of 13.6mmHg on an average of one glaucoma eyedrop medication [2].

The long term success over more than 10 years is difficult due to expense and other difficulties in performing very long-term studies and most research studies do not answer this question.

Complications

Severe complications are uncommon but are most likely to happen if the eye pressure drops very low or very quickly in the early postoperative period. A very low or an abrupt drop in eye pressure can cause a choroidal haemorrhage (severe bleeding at the back of the eye causing vision loss). This happens in less than 1% of aqueous shunts. About 5% of patients require a return to the operating theatre in the first month after surgery, either because of low pressure or high pressure. The risk of infection inside the eye causing vision loss from aqueous shunt surgery is rare (less than 1%).

There is also a small on-going risk that the shunt will: develop a blockage (requiring further surgery to unblock the tube), be exposed (the surface conjunctiva over the shunt breaks down, requiring a repair operation), or rub against the cornea requiring further surgery to reposition the tube or in extreme cases where significant corneal damage has occurred, a corneal transplant may be required.

References

1. Gedde SJ, Schiffman JC, Feuer WJ et al. Treatment outcomes in the Tube versus trabeculectomy (TVT) study after five years of follow-up. Am J Ophthalmol 2012;153:789-803.
2. PG Christakis et al. The Ahmed Versus Baerveldt Study: Five-year treatment outcomes. Ophthalmology. 2016;123(10):2093-102.

Emergency Eye Clinic: 02920 743 191

Monday to Friday, 9am–5pm, for information and advice on eye conditions and treatments from experienced ophthalmic-trained nurses.