This free booklet is brought to you by the International Glaucoma Association (IGA), the charity for people with glaucoma. We haven’t charged for it because we want you to have easy access to information that will help you understand and manage glaucoma.

However, each of our booklets costs about 70p to produce. They are paid for by our supporters - mostly people just like you, as we receive no Government or statutory support.

If you find this booklet helpful, please consider making a donation to support our work, or become a member of the IGA. You will find a pull-out application form for membership in the middle of this booklet in order to receive the quarterly IGA News.

To make a donation call 01233 64 81 64 or visit our website at www.glaucoma-association.com. Alternatively, donate up to £10 by texting EIGA11 followed by either 1, 2, 3, 4, 5 or 10 to indicate the amount of your donation, to 70070. The text message is free and all of your donation will be passed to the IGA.

Your feedback is also important to us. Please help us to improve our information by sending us your comments about the content and format of this publication at marketing@iga.org.uk or by writing to us at the address below.

International Glaucoma Association
Woodcote House, 15 Highpoint Business Village
Henwood, Ashford, Kent TN24 8DH
Contents

1. Introduction –
   What are aqueous shunts and what do they do? 2

2. How will the shunt affect the external appearance of the eye? 5

3. Medication prior to surgery 9

4. The surgery itself 9

5. After surgery – post-operative care 12

6. Success rates and complications 17

7. References 20

8. Glossary 21

9. Acknowledgements 23

10. Disclaimer 23

Further help and information 24
1. Introduction – What are aqueous shunts and what do they do?

Aqueous shunts are devices that are used to reduce the intraocular eye pressure (IOP) in glaucoma by draining the fluid (aqueous humour) from inside the eye to a small blister or bleb behind the eyelid. Reducing the pressure on the optic nerve in this manner prevents further damage and further loss of vision in glaucoma.

Please note that control of the eye pressure with an aqueous shunt will not restore vision already lost from glaucoma.

The aqueous humour is a fluid inside the eye and is not related to the tears. Watering of the eye is caused by tears, not aqueous humour. The aqueous shunt reduces the eye pressure by draining aqueous humour.

Aqueous shunts have various other names such as tube implants, glaucoma tube shunts, glaucoma drainage devices, glaucoma drainage implants and setons. These names all refer to the same thing. Although there are many types of shunt available, two brands are in common use today and they function in a similar fashion. These are called the Ahmed Glaucoma Valve and the Baerveldt
Glaucma Implant. In certain circumstances a third type, known as the Molteno Implant, might also be used.

Ahmed Glaucma Valve

Baerveldt 350 Implant
These shunts are made up of a small silicone tube (less than 1mm in diameter) attached to a plate. The tube takes the aqueous humour from inside the eye and drains it to the plate which sits on the white of the eye (sclera). The plate sits under the skin of the eye (conjunctiva), behind the eyelid.

Although all shunts perform approximately the same function, there are important differences that affect the eye pressure in the first few weeks after surgery and other differences that influence the healing of the eye around the shunt and the long-term eye pressure.

The Ahmed Glaucoma Valve contains a type of valve that helps to prevent very low eye pressure during the first few weeks after surgery. The Baerveldt and Molteno implants do not contain valves but do have other advantages.

Because the Baerveldt and Molteno implants have no valve, they must be blocked with a stitch that is either tied around the outside of the silicone tube (external ligature), or threaded through the inside of the tube (occluding suture) at the time of surgery. The purpose of the stitches is to prevent the shunt from draining excessively in the first few weeks after surgery and causing the eye pressure to be too low.
2. How will the shunt affect the external appearance of the eye?

**On the outside of the eye**
Initially after surgery the eye will be red and swollen to a variable degree. After major eye surgery the eyelid often droops. This normally resolves over a period of weeks to months. The aqueous shunt itself is not normally visible on the outside of the eye.

When the shunt is functioning normally, the drained fluid accumulates in a blister or bleb in the conjunctiva. The plate and its bleb are positioned far back behind the

![Plate portion](image)

The plate portion of a shunt can be seen just underneath the eye surface when the eyelid is lifted up manually.
eyelid so they cannot usually be seen. This fluid is slowly absorbed by the blood vessels on the eye surface. The shunt and bleb in the pictures above are visible only because the eyelid has been lifted up manually. Occasionally, the shunt or bleb can be seen in extremes of gaze, when the eye is looking very far down and in.

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

A patch made of donor eye tissue, either from the sclera
(the wall of the eye) or cornea (transparent tissue that forms the front of the eye) is often used to keep the shunt in place. This is the only part of the operation that might be visible after surgery.

**On the inside of the eye**

The tube part of the shunt is placed inside the eye at the time of surgery. This is very small and cannot be seen with the naked eye. The illustrations below show the appearance of the tube when viewed at high magnification. The outside diameter of the tube part of the implant is 0.6mm and the internal diameter, 0.3mm. The tube itself is made of transparent silicone. The length of the tube inside the eye is usually 1 – 2mm.

In the photograph below, the tube is seen entering the eye just in front of the brown iris.

![Internal opening of the tube inside the eye.](image)
In the photographs below, the tube part of the shunt can be seen just in front of the blue iris. A white nylon occluding suture/stitch (Supramid), which is used to partially obstruct the tube in order to help regulate the eye pressure, can also be seen inside the tube.

Baerveldt tube partially obstructed by a white nylon suture/stitch (Supramid) inside the eye (just in front of the blue iris).
3. Medication prior to surgery

Prior to undergoing surgery, patients are asked to continue all drops and tablets in accordance with their normal treatment regimen up until the morning of the operation. Blood thinning medications such as Aspirin, Warfarin and Clopidogrel should also be continued. Your clinician may ask you to stop taking blood thinning medication prior to surgery to ensure it is within the correct therapeutic range.

If patients opt to have the surgery performed under general anaesthesia, a pre-operative assessment of their general health will be carried out prior to the surgery. Underlying medical conditions including cardiac disease, uncontrolled high blood pressure or diabetes will need to be addressed prior to scheduling of surgery.

4. The surgery itself

Aqueous shunt surgery may last one to two hours.

Anaesthesia
Aqueous shunt implantation is often performed under general anaesthesia, although local anaesthesia is also possible under certain circumstances.
Patients who have their surgery under local anaesthesia will be awake during the operation but will have the option of requesting light sedation. The eye will be anaesthetised first with eye drops and then an injection of anaesthetic will be administered around the eye. The anaesthetic injection itself may cause some mild discomfort; a slight sensation of pressure as the anaesthetic is delivered. The injection anaesthetises the eye, preventing not only pain but also excessive eye movement during surgery. During surgery patients are covered by a sterile sheet, or drape, which keeps the operation site sterile and also prevents patients from seeing any of the surgery. Patients will be aware of the surgeon working around the eyes, but it should not be painful. In the event of any pain or discomfort, calmly raise a hand and the surgeon will stop the surgery and top-up the anaesthetic if needed. Patients may also hear the surgeon speaking to the scrub nurse and other members of the surgical team.

**Mitomycin C**

During the surgery, the drug Mitomycin C may be applied to the surface of the eye for a brief period of time (up to five 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 prevents the shunt from functioning in the long term, as it prevents the
aqueous humour from being absorbed back into the circulation. 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 either from an eye bank (cornea or sclera) or from a commercial source (pericardium) is used to prevent break down of the conjunctival 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 per cent of cases. When donor tissue is used the risk of breakdown is less than three per cent.

The donor tissues used in aqueous shunt surgery are not live transplants. They are simply used to reinforce the eye surface over 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.

Please note that after receiving donor tissue patients are no longer eligible to donate blood in the United Kingdom.
5. After surgery – post-operative care

Patients are usually discharged home from hospital either the same day as the surgery or the following day. It is preferable to examine the eye again one day after surgery.

Further visits to the hospital following surgery
Some hospitals may provide overnight accommodation for patients travelling from afar.

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. The eye may be bloodshot for a few days following surgery.

Patients are advised to ask a friend or relative to accompany them home after surgery, especially patients who have poor sight in the unoperated eye or those who have had general anaesthesia.

It is usually best to avoid wearing make-up for approximately four weeks after surgery, depending of course on individual reactions to surgery.
Eye drops
Eye drops will be prescribed to use regularly after surgery. These are commenced on the day after surgery, after the post-operative examination. It is not usually necessary to use eye drops the first night after the surgery.

Acetazolamide (Diamox) tablets should also be stopped the night of surgery unless advised otherwise.

It is important that any eye drops for the unoperated eye are continued unless advised otherwise. The post-operative eye drops will usually consist of an antibiotic (e.g. chloramphenicol) and anti-inflammatory steroid (e.g. dexamethasone). The steroid eye drop will initially be used intensively (every two hours or about eight times daily) and the antibiotic four times daily. During the period of intensive usage preservative-free drops may be used. When drops are prescribed to take intensively after surgery, it is usually intended that they are taken during the day only. If overnight intensive use is intended, then the patient will be advised of this separately.

Patients are given a supply of post-operative eye drops on leaving the hospital; these should last one month. The post-operative eye drops will normally need to be taken for two to three months. Patients are advised at each post-operative visit whether a change in the dosage of drops is
required. The drops should not be stopped or the dosage changed without consulting the doctor.

Post-operative clinic visits
Patients are usually seen once a week for the first four weeks, and may be seen more frequently if the eye pressure is either too high or too low.

Patients who find it difficult to visit their surgeon will likely be able to alternate post-operative appointments between said surgeon and their local ophthalmologist.

High pressure after surgery
In some cases, the ligature or occluding suture may cause high pressure after surgery. A ligature can be cut using a laser, usually two to three weeks after surgery at which point the pressure drops. This procedure is very quick, painless and is performed in out-patients. The occluding suture inside the tube can usually be removed after three months and occasionally before. The occluding suture can sometimes be removed in clinic but more often requires a return to the operating theatre to have it removed as a short operation.

It is important to note that these sutures do have an important purpose; to protect the eye from the effects of low pressure in the first few weeks after surgery. If the
pressure is high in the first weeks after surgery this does not mean that the shunt will not work, but simply that the shunt is not working yet. In such cases, 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 may be 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 within the operated eye.

Low pressure, when it occurs, is usually detected during clinic appointments and is often remedied 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 important to avoid strenuous activity during the early post-operative period including swimming, tennis, jogging and contact sports.

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

As patients will be monitored closely following surgery, it is recommended that they consult their doctor before commencing strenuous activity. If the eye pressure is very low after surgery the doctor may suggest refraining from all exertion and remaining sedentary until the pressure is restored.

When can I go back to work/school?
The duration of time off work/school will depend on a number of factors such as the nature of the patient’s employment, the state of the vision in the other eye and the pressure in the operated eye.

Typically someone working in an office environment would require two weeks off, if the post-operative course is smooth. Someone whose occupation involves heavy manual work or work in a dusty environment may require a month or more (e.g. builders, farmers). This can be discussed with your consultant.
Contact lens use after aqueous shunt implantation
It is usually possible to restart contact lens wear around four weeks and sometimes sooner after aqueous shunt implantation.

Flying after surgery
Although it is safe to fly after surgery, patients should bear in mind that their surgeon will wish to see them for a number of post-operative visits to ensure that the tube is functioning properly and that the eye pressure is at the correct level.

When is the eye back to normal?
In most cases, it takes two to three months for the eye to feel completely normal and sometimes longer in more complicated cases. At this point the patient will usually have a refraction (spectacle) test as the spectacle prescription may have changed slightly from the pre-surgery prescription.

6. Success rates and complications

Success rates
Most glaucoma surgical studies examine success rates over a five year period. With aqueous shunts such as the Baerveldt, the expected success rate over five years is now between 70 and 80 per cent. Although a sizeable
proportion of patients achieve good pressure control without the need for continued glaucoma medication, many patients still require some medication to assist the shunt in controlling the pressure.

In such circumstances, the medication required is usually less than that required before the surgery; in one recent study using the Baerveldt implant the success rate after five years was 70 per cent and the average patient achieved a pressure of 14.4mm Hg on an average of one glaucoma eye drop medication after five years.¹

In a study at the author’s eye hospital (2005) using the same implant, the average eye pressure was 11.6mm Hg with only one in four patients requiring a glaucoma eye drop medication to control the pressure by two years after surgery.²

Patients often ask about long term success over 10 years, 15 years or more. Because of the expense and other difficulties in performing very long-term studies, most research studies do not answer this question. Studies that have been carried out over longer periods show that most implants which are functioning successfully at five years continue to do so over longer periods of time.³-⁶
Complications

Aqueous shunt surgery has become more popular as a treatment for uncontrolled glaucoma in recent years partly because of improved safety, but also because success rates have improved.

Severe complications are uncommon but are most likely to happen if the eye pressure drops very low or very quickly in the early post-operative period. A very low or an abrupt drop in eye pressure can result in a choroidal haemorrhage (severe bleeding at the back of the eye). This happens in less than one per cent of aqueous shunts, in the author's experience. If the pressure drops very low it may be elevated again either using an injection of a viscoelastic gel or a gas into the eye in the clinic, or by a return to the operating theatre to have the tube adjusted. These interventions are only performed when the pressure is very low in order to prevent complications such as a choroidal haemorrhage, rather than waiting until after they occur.

In the author's experience, about five per cent of aqueous shunt patients required a return to the operating theatre in the first month after surgery for adjustment, either because of low pressure or high pressure (Moorfields Eye Hospital 2005-2006 aqueous shunt audit report, K Barton, June 2007).
The risk of serious infection inside the eye from aqueous shunt surgery, in the author's experience is rare (less than one per cent).

There is also a small long-term risk that the tube implant will; develop a blockage (requiring further surgery to unblock the tube); erode (the surface conjunctiva over the shunt breaks down, requiring a repair operation); or rub against the cornea requiring further surgery to either move the tube so it does not rub or, in extreme cases where significant corneal damage has occurred, a corneal transplant may be required.

7. References


8. Glossary

Aqueous humour
Fluid inside the front portion of the eye. This fluid is pumped into the eye by tissue called the ciliary body, and normally escapes via drainage channels called the trabecular meshwork. This fluid is completely separate from the tears and excessive tearing does not mean that the aqueous humour is draining well.
Conjunctiva
A thin transparent layer of skin covering the surface of the white of the eye.

Cornea
Transparent tissue at the front of the eye in front of the iris and lens.

Intraocular pressure
The pressure inside the eye. In glaucoma, high intraocular pressure is the main cause of damage to the optic nerve. This is usually measured in units known as mm Hg (millimeters of mercury). In patients with normal tension glaucoma, lowering the eye pressure still slows the condition.

Mitomycin C
Mitomycin C is an anti-scarring drug that was originally used to treat cancer.

Optic nerve
The large nerve connecting the eye to the brain. The optic nerve carries all of the visual impulses from the eye. These are then translated by the brain into the images that we see.
Sclera
The wall of the eyeball itself. This is seen from the front as the white of the eye.

9. Acknowledgements

The author would like to thank Emma Jones, Abigail Mackrill, Rashmi Mathew, Kirithika Muthusamy, Chris Smith and Eleanor Wilkinson as well as a number of patients and their relatives for their help in the preparation of this document.

10. Disclaimer

Accuracy
Whilst every step has been taken to compile accurate information and to keep it up-to-date, we cannot guarantee its correctness and completeness. The information provided in this information sheet is designed as an adjunct to, and not a substitute for, professional healthcare advice by a qualified doctor or other healthcare professional, which will be tailored to a patient's individual circumstances. Keith Barton, the International Glaucoma Association and Moorfields Eye Hospital NHS Foundation Trust cannot take responsibility if patients rely solely on the information in this information sheet.
Further help and information

Telephone us
The IGA operates a telephone advice line, called Sightline.

If you would like to find out more about any of the information contained in this booklet, or you would like to discuss any concerns you may have about glaucoma, you can call the IGA’s Sightline. Out of office hours there is an answer phone service where you can leave a message and you will be called back.

Sightline: 01233 64 81 70
Monday - Friday 9.30am - 5.00pm

Visit our website: www.glaucoma-association.com for a wide range of information, to order other booklets or leaflets, or to participate in our on-line discussion forum.

Email us at: info@iga.org.uk
Other IGA booklets and leaflets

The IGA produces a range of informational booklets and leaflets. These are constantly being reprinted, reviewed and updated so call Sightline, or visit the website, to find out what is currently available.

Aqueous Shunt Implantation
Author: Keith Barton MD FRCP FRCS
Moorfields Eye Hospital NHS Foundation Trust

Medical Editor: Anthony J King MD FRCOphth
Queens Medical Centre, University Hospital, Nottingham

How to contact us

**Telephone:** 01233 64 81 64
(donations and general enquiries)

**Sightline (help and advice):** 01233 64 81 70
Monday-Friday 9.30am - 5.00pm

**Email:** info@iga.org.uk

International Glaucoma Association
Woodcote House, 15 Highpoint Business Village
Henwood, Ashford, Kent TN24 8DH

Charity registered in England and Wales No. 274681
and in Scotland No. SC041550
© International Glaucoma Association 2015
Patient support group

We have many patient support groups around the country run by hospital staff for the benefit of people with glaucoma. A list of these, along with contact details, can be found in our newsletter or on our website at www.glaucoma-association.com

Buddies

If you are due to have surgery for your glaucoma, you may feel that you would benefit from speaking to someone else who has already had that experience. We have a list of people who are willing to do this. You may find that after your own experience that you decide that you too would like to become a buddy.

For further information on the either of the above, please contact Sightline on 01233 64 81 70 or info@iga.org.uk
The International Glaucoma Association is the charity for people with glaucoma

Core values

• **Compassion** – We will treat everyone who needs our help and assistance with empathy, sincerity and care

• **Honesty** – We will conduct ourselves and our activities with trust and integrity

• **Excellence** – we are passionate about everything we do, and committed to “going the extra mile” individually and collectively

• **Equality** – We respect each other and value diversity

• **Relevance** – We will evolve to serve the needs of our audience so that we are relevant both today and tomorrow.

Vision statement

Our vision is that all people with glaucoma and those at risk should have the knowledge and access to the care they need to avoid preventable sight loss.

Mission

The International Glaucoma Association is the charity for people with glaucoma, an eye condition that may lead to loss of sight. Our mission is to raise awareness of glaucoma, promote research related to early diagnosis and treatment and to provide support to patients and all those that care for them.
Don’t Forget!

• Use your eye drops as prescribed by your consultant to avoid further sight loss in most cases.

• Tell your close relatives that you have glaucoma. They are at higher risk than average so should be tested regularly, and first degree relatives over the age of 40 are entitled to free eye tests.

• Contact the IGA Sightline if you have any questions. We are here to help.

• Join us! A membership form is enclosed in the middle of this booklet. If you are a member already, please pass it to a relative or friend. You may save someone’s sight:
  • Support leaflets for other patients!
  • Support research into the causes and treatment of glaucoma
  • Receive the quarterly IGA News

The information contained in this booklet was correct at the time of printing.
The International Glaucoma Association is registered under the Data Protection Act 1998 of the United Kingdom. Any information you provide will be held on a database within the UK. The database will be administered and controlled by the International Glaucoma Association, Woodcote House, 15 Highpoint Business Village, Henwood, Ashford, Kent TN24 8DH. You agree that we may use any information you supply in the following way:

- To maintain records of donations and requests for information

- To use for future requests for support

Only the IGA will have access to your information. It will not be disclosed to other third parties except to the extent required by the laws of the United Kingdom. If you do not wish us to use your information in this way, please state when calling that you do not consent for your information to be used for this purpose.