CHAPTER 6

GLAUCOMA

Glaucoma is a common disease and an important cause of blindness. This chapter will briefly describe the clinical picture of the different sorts of glaucoma and then concentrate on the surgery of glaucoma. It is particularly important to understand the indications for surgery and the choice of operation. Medical treatment is important to prepare the eye for surgery but long-term medical treatment is not usually appropriate.

Glaucoma is a disease in which the optic nerve is damaged. This is nearly always caused by *raised intraocular pressure*, and the basic treatment is to lower the intraocular pressure. There are two common types of glaucoma, primary open angle glaucoma (sometimes called chronic simple glaucoma) and angle closure glaucoma. There are numerous other causes which are very much less common.

The normal intraocular pressure is 10–20 mm Hg (millimetres of mercury). The pressure is regulated by the production of aqueous in the eye and its drainage from the eye (see fig. 6.1). The aqueous is produced by the ciliary processes and passes between the lens and the pupil margin into the anterior chamber.

Once in the anterior chamber the aqueous is absorbed through the trabecular meshwork which is situated in the angle of the anterior chamber. From there it passes into the canal of Schlemm and so out of the eye. The trabecular meshwork acts as a kind of sponge allowing aqueous to pass slowly through it into the canal of Schlemm. If the trabecular meshwork is not functioning well the intraocular pressure will gradually rise. This is called ***primary open angle glaucoma*** (fig. 6.2)

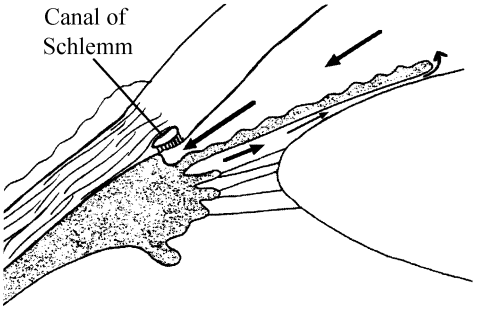

Fig. 6.1 To show the production, circulation and drainage of aqueous fluid in the eye

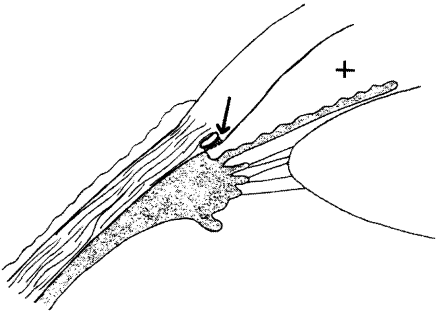

Fig. 6.2 The mechanism of open angle glaucoma. The aqueous drainage through the trabecular meshwork and into the canal of Schlemm (arrowed) is impaired, and so the intraocular pressure rises.

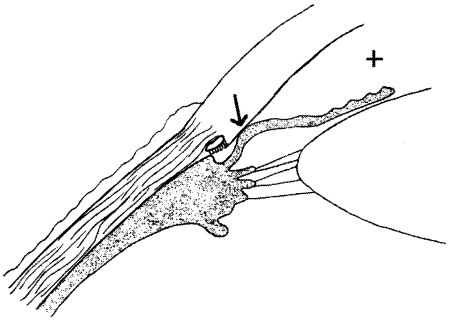

Fig. 6.3 Angle closure glaucoma. The arrow shows where the iris is obstructing the flow of aqueous.

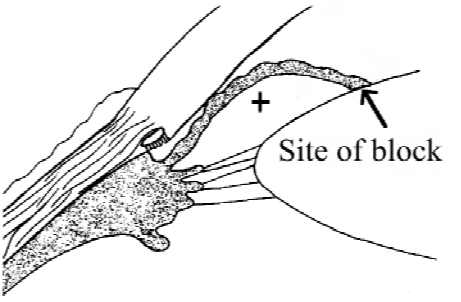

Fig. 6.4 The mechanism of pupil block glaucoma

and it always develops very gradually and slowly. It is the most common type of glaucoma.

If the anterior chamber is very shallow the iris may touch the back of the cornea, preventing aqueous from reaching the trabecular meshwork so the pressure rises. This is called an angle closure attack, and if it persists will cause ***angle closure glaucoma*** (fig. 6.3). It usually comes on rapidly, with severe and acute symptoms. It is the second most common type of glaucoma.

The trabecular meshwork may become blocked in other ways and result in some of the other less common types of glaucoma. It may be blocked by:-

- White blood cells and protein exudate – secondary glaucoma from intraocular inflammation or uveitis.
- Red blood cells – secondary glaucoma from an intraocular haemorrhage (hyphaema).
- Growth of new blood vessels – neovascular or thrombotic glaucoma.
- Lens protein and macrophages – phacolytic glaucoma.
- A fine membrane of mesodermal tissue – congenital glaucoma.
- Post operative adhesions between the periphery of the iris and the cornea called peripheral anterior synechiae.

If the pupil is completely adherent to the lens, aqueous cannot even enter the anterior chamber. The iris bows forward and the intraocular pressures rises. This condition is called *pupil block glaucoma* (fig. 6. 4), but it is much less common.

The signs of open angle glaucoma

1. Raised intraocular pressure

Most patients with glaucoma have raised intraocular pressure. A pressure of between 20 to 30 mm Hg is increasingly suspicious of glaucoma. Pressure above 30 mm Hg is definite evidence of glaucoma. The intraocular pressure is measured with a tonometer. A "Schiotz" tonometer is reasonably accurate as long as it is kept scrupulously clean and used correctly. The Applanation or "Goldmann" tonometer is more accurate.

This rise in intraocular pressure causes two other changes in the eye: atrophy of the optic nerve and defects in the visual field. These will be present in all patients with glaucoma. A few patients develop optic atrophy and visual field defects even though their intraocular pressure is normal. This is usually called normal tension (or low tension) glaucoma.

2. Optic atrophy

The optic nerve is the first structure in the eye to be damaged by raised intraocular pressure. The nerve atrophies and so the optic disc appears white. The atrophy follows a particular pattern and the optic disc also appears cupped or hollowed out. Many normal eyes have a small portion of the optic disc which is pale and cupped. Because the optic disc varies in size from person to person, there is considerable natural variation in the size of this central cupped area in healthy normal eyes. In glaucoma this cupped and pale central portion enlarges because the nerve fibres which make up the solid outer part of the optic disc atrophy. Finally the pale cupped area fills up the whole disc. It is usual to measure the cup/disc ratio. That is the proportion of the optic disc which is hollowed out by this pale area. The following disc changes are all very suspicious of glaucoma:

- A cup/disc ratio of greater than 0.5.
- A cup/disc ratio which is different in the two eyes by 0.2 or more.
- Notches or thin areas in the outer rim of the optic disc.

3. Visual field loss

As the optic nerve atrophies the vision is affected. The vision deteriorates in a characteristic way, with defects in the visual field spreading out from the blind spot but preserving the central vision and the visual acuity. Finally all the vision is destroyed, and the eye becomes completely blind. Any sight loss is permanent and will never recover, so glaucoma must be diagnosed in its early stages when the patient still has useful vision. Once the eye is blind no treatment will restore vision.

Unfortunately glaucoma is difficult to diagnose in the early stages for 2 reasons:-

- *The patient* will not complain of any pain and may not be aware of the gradually increasing defects in the visual field.
- *The person examining the eye* may not notice the changes of glaucoma. The intraocular pressure needs to be carefully checked and the optic nerve examined. It needs time and patience to plot the visual field and detect small defects in it.

Open angle glaucoma is a *bilateral disease*, it nearly always affects both eyes. However it often affects one eye worse than the other, so that the patient may be almost blind in one eye and still have useful sight in the other.

Any patient with optic atrophy will have an *afferent pupil defect*. If one eye is worse affected than the other there will be a relative afferent pupil defect, as demonstrated by the swinging torchlight test (see footnote at the end of this chapter). Because glaucoma is the most common cause of optic atrophy and is often worse in one eye than the other, the swinging torchlight test is a very simple and quick screening test that will detect most cases of glaucoma.

The signs of angle closure glaucoma

In acute angle closure glaucoma the intraocular pressure rises very rapidly to a high level so the clinical signs are very different. The symptoms usually come on very suddenly and acutely. There is rapid and severe loss of vision, and the patient may be in considerable distress. The eye is inflamed and painful, the pupil is fixed and dilated and the cornea is oedematous and appears hazy. The anterior chamber is very shallow, and if a slit lamp is available an examination with a special mirrored contact lens called a gonioscope will be able to confirm that the iris is touching the back of the cornea. (Sometimes angle closure glaucoma will develop slowly and gradually rather than suddenly. This is called chronic angle closure glaucoma, and the symptoms and changes in the optic nerve are just like open angle glaucoma, and the treatment is the same as well.)

Acute angle closure glaucoma is usually a *unilateral disease*, usually only one eye is affected. However the other eye will also have a shallow anterior chamber, and so it is very likely that sometime in the next few years the other eye will also have an attack of angle closure glaucoma.

Acute angle closure glaucoma should always be treated surgically.

Diagnosis

It is important to diagnose glaucoma at an early stage, and also to identify the exact type of glaucoma from a careful history and clinical examination. This is not always easy without a slit lamp, but it is important as it affects the treatment. Consider for example a patient with one eye blind from glaucoma and the other eye apparently normal:

If the affected eye has gone blind from angle closure glaucoma, then the other eye must have an iridectomy.

If the affected eye has gone blind from open angle glaucoma, the other eye is likely to have early open angle glaucoma or could develop it in future years. It may need treatment now or at some stage in the future.

If the affected eye has gone blind from secondary glaucoma, the other eye probably needs no treatment or supervision at all.

It is helpful to remember that open angle glaucoma is more common amongst blacks, and that angle closure glaucoma is common in the mongoloid races but rare in blacks. Both angle closure and open angle glaucoma become increasingly common with increasing age.

Patients with glaucoma are often not seen until they have already lost the sight in one eye. They often have great difficulty in understanding the surgeon's interest in the other eye which can still see. The patient is anxious about the *blind* eye, and hoping that something can be done to restore the sight. The surgeon is anxious about the *seeing* eye, and trying to decide the best plan to save what vision is left. This obviously requires a lot of patience and sympathy from the surgeon in explaining the situation to the patient.

There are five treatment options possible for a patient with glaucoma:

1. Medical treatment
2. Surgical treatment

3. Laser treatment
4. Symptomatic treatment for pain
5. No treatment

Medical treatment

There are several drugs which will lower the intraocular pressure.

- Beta sympathetic blocking drugs lower the production of aqueous from the ciliary body. Timolol drops 0.25% or 0.5% twice daily is the most popular but there are others available.
- Carbonic acid anhydrase inhibitors also lower the production of aqueous. Acetazolamide 250 mg by mouth up to 4 times daily or dorzolamide drops 2% three times daily can be given.
- Parasympathetic stimulating drugs constrict the pupil and also improve the flow of aqueous from the eye. Pilocarpine 1% to 4% four times daily is the drug of choice.
- Adrenaline (epinephrine) 1% twice daily drops lower the intraocular pressure by improving the outflow of aqueous. Brimonidine is a similar drug which has recently been introduced.
- Latanoprost. This is a new drop which improves the outflow of aqueous from the eye, and is given once daily. It is very effective but like all new medication it is very expensive.
- In severe cases osmotic diuretics will produce a short and dramatic fall in the intraocular pressure (Glycerol by mouth or Mannitol by i.v. injection are both osmotic diuretics. They may have unpleasant side effects and should be avoided if possible).

There are three indications for medical treatment.

1. *In glaucoma secondary to uveitis*. Both the uveitis and the glaucoma should be treated until the uveitis resolves. The intraocular pressure will then return to normal. (Pilocarpine should not be used for this type of glaucoma).

2. *To prepare the eye for surgery by bringing down the intraocular pressure to normal.* Operating on an eye with raised intraocular pressure has a risk of causing a sudden intraocular haemorrhage, and so for all glaucoma surgery the intraocular pressure should first be controlled with medical treatment if possible.

In acute angle closure glaucoma, urgent and intensive treatment to lower the intraocular pressure is needed. Intensive Pilocarpine drops (every hour for a few hours and then four times a day) should be applied to the affected eye, as well as Timolol drops twice daily and Acetazolamide tablets four times daily. If the intraocular pressure has still not fallen, massaging the eye by indenting the central cornea or osmotic diuretics (see above) may lower the intraocular pressure, and so may giving a general anaesthetic. Steroid drops to the affected eye will help by suppressing the inflammation.

Pilocarpine drops four times a day must be applied to the other eye whilst waiting for surgery, as this eye is at risk of developing angle closure glaucoma.

When operating on an eye with primary open angle glaucoma it is best to lower the intraocular pressure preoperatively. This does not usually take more than a few days. Timolol and Pilocarpine should be used first and Acetazolamide also given if necessary.

3. *To give long-term control of the intraocular pressure in primary open angle glaucoma*. Medical treatment is usually recommended in developed countries as the treatment of choice. However medical treatment has several disadvantages.

- For medical treatment to succeed the patient must take the drops regularly for the rest of his or her life, and be checked regularly to ensure that the treatment is working, and that there are no side effects from the treatment.
- A life time of medical treatment and supervision is very costly.
- Medical treatment may work at first, but the glaucoma may get worse as the patient gets older.
- It seems that long term medical treatment causes inflammation in the conjunctiva so that if surgery is attempted later, the chance of success is less.

Obviously a life time of medical treatment is not appropriate for most patients in developing countries. Even where it is possible to give and supervise medical treatment, it seems the long-term results from surgery are as good as or better than those from medical treatment, except in mild cases or very elderly patients.

Surgical treatment

There are two operations which are commonly performed in glaucoma, an iridectomy and a drainage operation.

Iridectomy

The purpose of an iridectomy is to allow the aqueous to circulate inside the eye, from behind the iris to the anterior chamber (fig. 6.5). If done properly it is a very simple and successful operation with few complications.

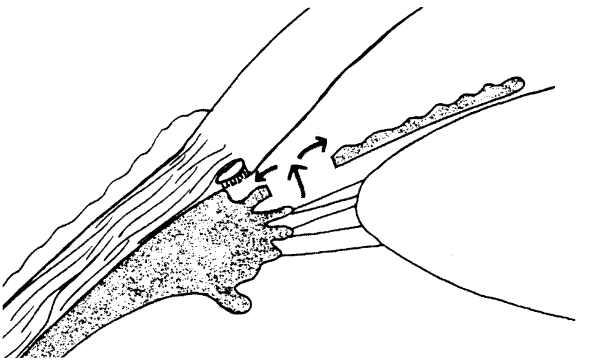

Fig. 6.5 Angle closure and pupil block glaucoma cured by an iridectomy

The indications for iridectomy:

- To treat an eye with acute angle closure glaucoma, if the pressure has come down and is well controlled on medical treatment with drops alone.
- To prevent angle closure glaucoma occurring in the second eye of a patient whose first eye has developed acute angle closure glaucoma. An iridectomy must be performed in all these eyes.
- For any sort of pupil block glaucoma, if the pupil block has not been cured with mydriatic drops.

Drainage operations

The purpose of drainage operations is to make a pathway for the aqueous to leave the eye, so that it can be absorbed into the subconjunctival tissues, the blood vessels and the lymphatics (fig. 6.6). It forms a raised fluid "bleb" where the aqueous collects in the subconjunctival tissues. Some of the aqueous may drain into the cut end of the canal of Schlemm, and some may pass into the supra-choroidal space. However patients with a good bleb usually have a good result, and those with a poor bleb a poor result, so it would seem that most of the aqueous drains out subconjunctivally.

Many different types of drainage operation have been described for glaucoma such as a trephine, sclerectomy, Scheie's operation and trabeculectomy. They seem to be equally effective at achieving drainage, but the trabeculectomy allows the aqueous to drain from the eye in a more controlled manner. A trabeculectomy therefore has less post operative complications, and will be described here as the operation of choice. A Scheie's operation will also be described because it is easy to do, and may have a place when working in difficult circumstances, although it is generally considered as rather out dated and obsolete.

The indications for a drainage operation

The main indication is for primary open angle glaucoma where useful sight is still present. For useful sight the patient should at least be able to count fingers looking straight ahead. A simple functional test of the patient's vision is to see if they can

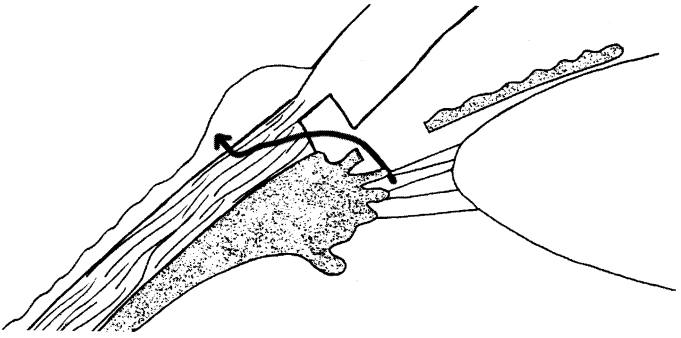

Fig. 6.6 Open angle glaucoma cured by a "drainage" operation

navigate around obstacles in a room without bumping into them. If the vision in the eye is not good enough for this then surgery is pointless.

Another very difficult decision is whether to operate on an eye with borderline early glaucoma. Drainage operations are not free of complications, and it may be the patient's only eye. If the diagnosis is certain and especially if the other eye is badly affected, it is best to operate as without treatment the sight will almost certainly deteriorate in the next few years. If the diagnosis is uncertain, it is best to wait and review the patient in six months or a year's time. Sometimes this in itself may be difficult to arrange.

There are other situations in which a trabeculectomy operation is recommended:

- In acute angle closure glaucoma, if there is still useful sight in the eye, but the pressure has not come down to normal with medical treatment; or if an iridectomy has been performed but the pressure is still raised.
- In other types of glaucoma for example aphakic or pigmentary glaucoma, if the raised intraocular pressure is long-standing and there is still sight in the eye.
- In congenital glaucoma, a very rare condition, the recommended treatment is a goniotomy operation. This is difficult to perform and needs special equipment. Most surgeons have very little experience of goniotomy, and so rather than attempt this operation a trabeculectomy is recommended and usually works satisfactorily.

It is most important to counsel patients very carefully before surgery for open angle glaucoma. Most patients think that they are going to see better after an operation, and it must be very carefully and sometimes repeatedly emphasised to them that the purpose of the operation is not to help them to see better, but to stop them going blind in the future.

Often patients do not seek medical advice until one eye is blind and the other also affected, so surgeons must take particular care with glaucoma operations. *Any mistakes or complications mean that the last little bit of sight may be lost for ever rather than preserved.*

Other operations

There are other possible operations to try to reduce the intraocular pressure in very severe cases, but usually they are not as successful as drainage operations.

- The ciliary body can be treated with diathermy, cryotherapy or laser in order to reduce the production of aqueous.
- A fine silicone tube sometimes attached to a valve can be inserted into the anterior chamber through a trabeculectomy incision to drain the aqueous out of the eye.
- A cyclodialysis cleft can be made from the angle of the anterior chamber into the supra choroidal space.
- Deep sclerectomy. In this recently described operation, some of the tissue around the trabecular meshwork and the canal of Schlemm is excised but the anterior chamber is not entered. It appears to be very successful but is difficult to perform.

Laser treatment

There are a few specialist hospitals and clinics where lasers are available. A YAG laser will make a small hole in the iris and so avoid having to do an iridectomy operation for angle closure glaucoma. An argon laser can be used to treat the trabecular meshwork in open angle glaucoma, and this will often help to lower the pressure in the eye.

Palliative treatment

If the eye is blind and painful there is no point in performing a drainage operation. The sight will not be restored, and severely inflamed eyes with very high pressures often develop complications from surgery. A blind painful eye often occurs in prolonged angle closure glaucoma or thrombotic glaucoma. For these patients steroid and atropine drops may relieve the pain. If not a retrobulbar injection of phenol or alcohol may help (see page 291). Finally if all else fails it may be necessary to remove the eye to cure the pain.

No treatment

If the eye is blind or virtually blind and free of pain there is no purpose in giving any treatment at all. It gives false hopes, it wastes the patient's and the doctor's time, and may discourage any of the patient's friends or relatives from seeking treatment if they have a treatable eye disease.

Surgical Technique

Iridectomy

Principle:

To remove a piece of iris to allow aqueous to circulate freely inside the eye. Usually a small piece is removed near the root of the iris. This is called a peripheral iridectomy.

Indications: These have been discussed in more detail on pages 187—8.

- To treat angle closure glaucoma.
- To prevent angle closure glaucoma.
- To treat pupil block glaucoma.

Preparation:

1. Medical treatment will have been given to the eye as previously described on pages 186–7 to control the intraocular pressure and constrict the pupil.
2. The eye is prepared as for any intraocular operation.
3. A full local anaesthetic block should be given.
4. The eyelids are retracted with a speculum, and the surgeon may wish to insert a superior rectus suture to help turn the eye down. This may not be necessary.

Method:

1. A small conjunctival flap is raised. This may be limbus based or fornix based (see page 25–6). Alternatively the incision can be in the peripheral cornea without raising a conjunctival flap at all. The operation is usually performed at the 12 o'clock position on the eye. If the eye has had an attack of acute angle closure glaucoma, some surgeons prefer to operate slightly to one side, at 10 o'clock or 2 o'clock. Then if the intraocular pressure remains high and a trabeculectomy is later needed, there is still space for it under the upper eyelid.
2. *Very* gentle cautery may be applied to the surface of the sclera at the incision site. This is only necessary if there are obvious blood vessels.
3. Using a scalpel blade or a razor blade fragment, an incision is made into the anterior chamber at the limbus (fig. 6.7). The site of the incision should be

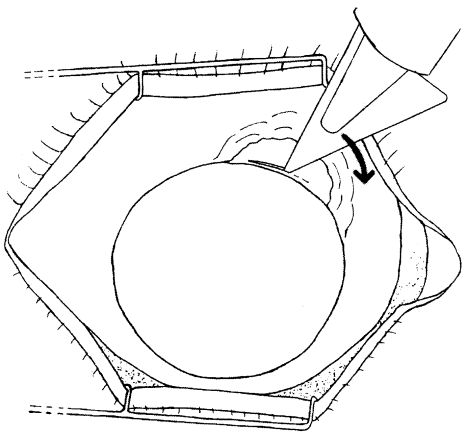

Fig. 6.7 Making the incision at the limbus

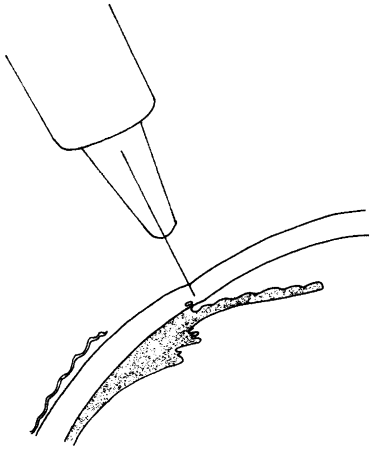

Fig. 6.8 To show the angle of the incision

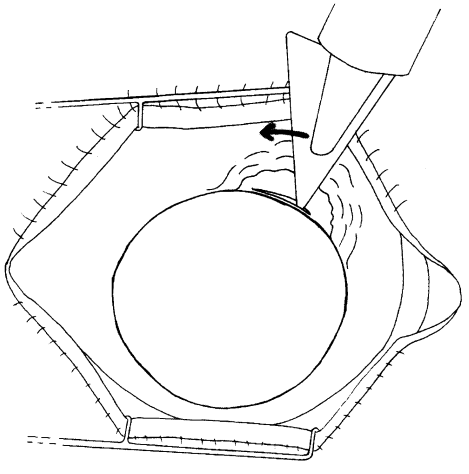

Fig. 6.9 Reversing the blade of the knife to complete the incision

where the clear cornea meets the white opaque sclera. It needs to be only 3–4 mm in length. Make sure that the incision is almost perpendicular to the cornea (at right angles to the corneal surface) so that it enters the anterior chamber near the angle of the anterior chamber and at the root of the iris (see fig. 6.8). As soon as the blade enters the anterior chamber a small amount of aqueous will leak from the incision lowering the intraocular pressure. The iris will probably plug the wound. Because of this it is very easy for the opening in the deep part of the wound not to extend the whole length of the incision, and so be too small to allow the iris to prolapse from the eye. The best way to make sure that the incision is full thickness in its entire length is to reverse the scalpel or razor blade once the anterior chamber has been entered, and cut in the opposite direction just using the tip of the blade (fig. 6.9). Try to avoid pushing the tip of the blade right into the eye where it may injure the iris (a complication) or puncture the lens capsule (a disaster).

4. Now a small knuckle of peripheral iris root should be prolapsed through the wound. The iris may prolapse spontaneously. If it does not, then apply gentle pressure on the posterior (scleral) lip of the incision and it should prolapse (fig. 6.10). If the iris still does not prolapse, then make sure the incision has entered the eye along its entire length. If it still does not prolapse insert non-toothed iris forceps into the wound to grasp the iris near its root and lift it out through the wound. Take great care not to even touch the surface of the lens with the forceps (see page 28).

5. Grasp the knuckle of prolapsed iris with a non-toothed iris forceps, and using a de Wecker's scissors excise this small iris knuckle (fig. 6.11). Make sure that a complete hole has been made in the iris including the black pigment on its deep surface. The iridectomy need only be very small, except in pupil block glaucoma when a larger iridectomy is advisable. Do not worry too much if by mistake the iris sphincter has been excised creating a full iridectomy, as the patient's vision will not be badly affected. There is usually no bleeding. If there is any bleeding, then by waiting patiently it will always stop in a few minutes.

6. The cut edges of the iris must now be replaced inside the eye. Gently massage the surface of the cornea just in front of the anterior lip of the wound with an iris repositor (see fig. 6.12). This usually succeeds in replacing the iris easily. When the iris is free from the incision, the pupil should be round and central. If this gentle massage does not succeed, and if a guaranteed source of sterile intraocular fluid is available, then gentle irrigation of the wound should free the iris from the wound edge. If sterile fluid is not available, the iris must be replaced by gently sweeping the wound edge with an iris repositor. Avoid pushing the repositor right into the anterior chamber.

7. Wound closure. Many people think that sutures are not necessary after an iridectomy as the wound is small and the edges soon seal with fibrin. If the operation has been done neatly through a small incision and the anterior chamber is still partly formed, this is indeed true. If there is any doubt about the wound closure, one corneo-scleral suture will close it adequately.

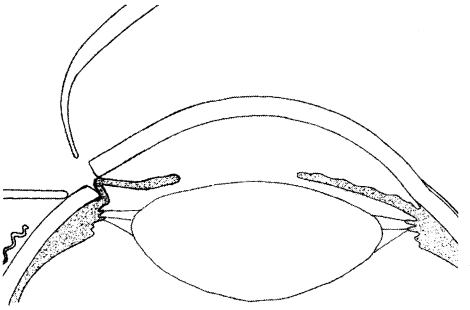

Fig. 6.10 Presure on the posterior lip of the wound to prolapse the iris

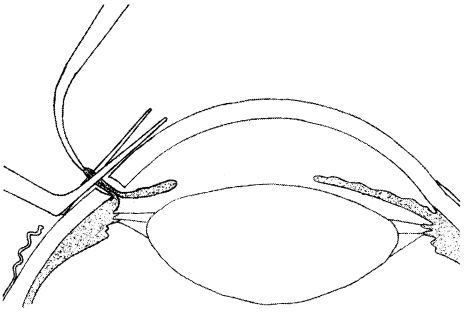

Fig. 6.11 Performing the iridectomy

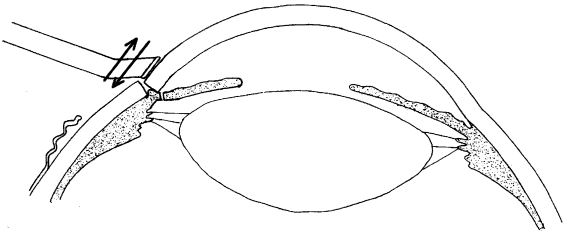

Fig. 6.12 Gentle pressure and massage on the anterior lip of the wound to replace the iris

Post-operative care:

At the end of the operation mydriatic drops are applied to dilate the pupil and prevent adhesions between the iris and the lens. Topical antibiotics and steroids are also given to prevent post-operative infection and iritis. A pad is usually applied for one day. Post operative complications are rare following iridectomy, but it is usual practice to keep the pupil dilated and apply topical antibiotics and steroids for a few days. Check the intraocular pressure before discharge. If the eye had suffered an acute angle closure glaucoma attack, there may be permanent adhesions in the anterior chamber angle preventing a satisfactory flow of aqueous from the eye. In such cases a trabeculectomy operation will be required.

Trabeculectomy

Principle:

To improve the drainage of aqueous fluid from the eye. A piece of trabecular tissue is excised under a flap of superficial sclera. A peripheral iridectomy is also carried out. The aqueous drains into the sub-conjunctival space at a controlled rate, and is then probably absorbed into the conjunctival blood vessels and lymphatics (see fig. 6.6). Some of the aqueous may possibly pass directly into the cut ends of the canal of Schlemm.

Indications (these are discussed in more detail on pages 188–9):

- In primary open angle glaucoma to prevent further sight loss.
- In any other type of chronic glaucoma where the optic nerve is damaged by raised intraocular pressure.

Preparation:

This is the same as for a peripheral iridectomy. Try to control the intraocular pressure preoperatively with medical treatment.

Method:

1. It is usual to rotate the eye downwards with a superior rectus suture (see pages 21–2). If the L.A. block has been very good, it may be possible to operate without a superior rectus suture. In particularly difficult cases of glaucoma some surgeons would advise rotating the eye downwards with a suture in the upper part of the cornea (see fig. 6.13). To do this a flat curved needle is inserted into half the thickness of the cornea about 2 mm from the upper limbus. The reason for avoiding the use of a superior rectus suture is that it may damage the subconjunctival tissues where the aqueous is planned to drain from the eye. In particular it may cause a subconjunctival haemorrhage and that would cause subconjunctival fibrosis and limit the benefits of the operation. However most surgeons still use a superior rectus suture and do not have any problems.
2. Then raise a flap of conjunctiva about 6 mm in length. This may be a fornix based or limbus based flap. For the reasons given on page 26 the fornix based flap is preferred. Lift up the conjunctiva with non-toothed forceps as near the limbus as possible at one end of the planned incision and make a small nick in the conjunctiva with scissors. Insert one blade of the scissors in this small hole,

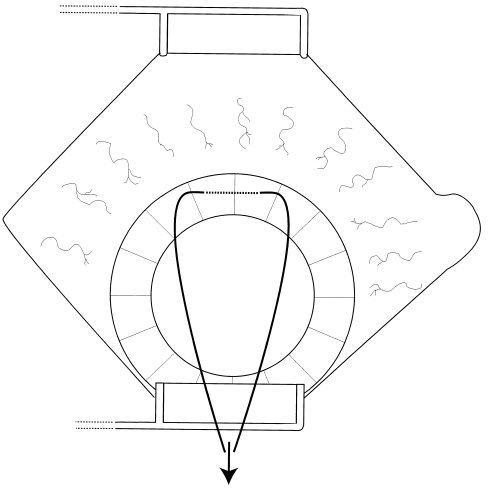

Fig. 6.13 A traction suture inserted into the upper cornea to pull the eye downwards

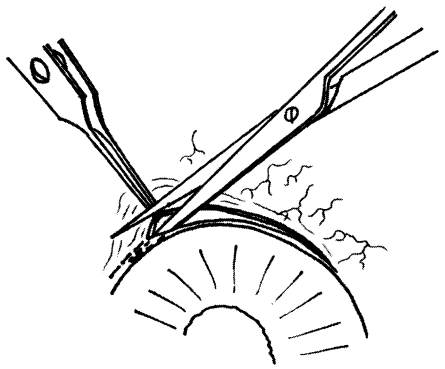

Fig. 6.14a

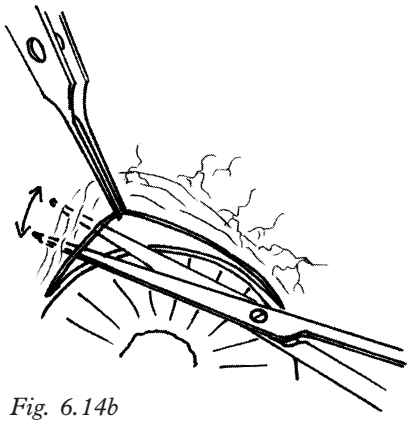

Fig. 6.14b

Fig. 6.14a and *6.14b* Dissecting a fornix based conjunctival flap

and cut round the conjunctiva as near to its corneal attachment as possible (fig. 6.14a). Then use the scissors to undermine the conjunctival flap and separate it from the sclera (fig. 6.14b). Allow the conjunctiva to retract back to leave a bare area of sclera. If the eye is pointing downwards because of traction on the superior rectus the conjunctiva will retract more.

3. There is a layer of loose connective tissue between the conjunctiva and sclera called Tenon's capsule. In young people this tissue forms a definite thin layer of connective tissue, but it atrophies in older patients. Tenon's capsule is inserted into the surface of the sclera about 2 to 3 mm back from the limbus, and it

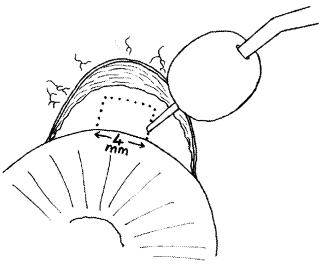

Fig. 6.15 Using light cautery to coagulate the blood vessels in the area of the scleral flap

Fig. 6.16 Possible shapes of the superficial scleral flap

needs to be separated from the surface of the sclera where the trabeculectomy is to be done. The easiest way to do this is just to cut its insertion into the sclera with a pair of scissors and it will retract backwards out of the way.

4. Mark out a flap of superficial sclera to be hinged at the limbus (fig. 6.15). The exact size, shape and position of this flap does not matter as long as it is 4 mm wide at the limbus. It is usual to make it rectangular in shape but some people prefer a trapezoid or a triangular flap (fig. 6.16). Plan the position of the flap so as to avoid any obvious large blood vessels lying on the surface of the sclera.

   Having chosen the place for this flap, apply light cautery or diathermy to the surface of the sclera over the area of the flap. This should be just sufficient to blanch the vessels without burning the sclera.

5. Use a scalpel blade or razor blade knife to cut lightly into the sclera along the edges of the flap. Dissect this flap back to the limbus. Start at one corner lifting up that corner with fine toothed forceps and aim to dissect the flap both across to the other corner and down to the limbus (fig. 6.17).

   The flap should be about half the scleral thickness. If it is too thin the flap will appear transparent and may curl up and fray at the edges. If it is too thick the black of the choroid and ciliary body will be seen through the bed of the flap. The dissection is continued forwards until it just passes across from opaque sclera into clear cornea. Try to make this dissection in one smooth layer as this improves aqueous drainage.

6. Making a limbal puncture. At this stage it is helpful to make a small self sealing puncture wound into the anterior chamber at the limbus. This is done with a fine hypodermic needle or a sharp tipped knife. The purpose of this is to be able to test the tightness of the wound later on by injecting saline or Ringer's solution into the anterior chamber (fig. 6.18). If the tip of the needle is directed downwards towards the six o'clock position and away from the lens it will avoid damaging the lens or iris and help to make this puncture wound self sealing.

7. The deep block of (trabecular) tissue is now excised. The operation is called a "trabeculectomy" because this tissue is from near the trabecular meshwork, but it is best to take it from the peripheral part of the cornea. This should be a rectangle 3 mm x 2 mm (see fig. 6.19). The anterior cut should be at the anterior end of the dissection just in clear cornea and the posterior cut where

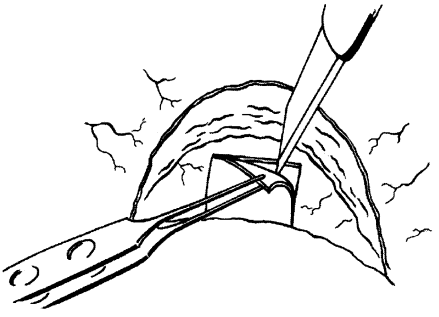

Fig. 6.17 Dissecting the superficial scleral flap

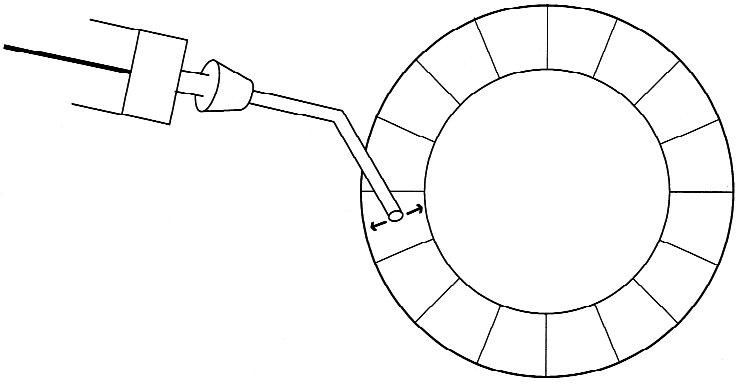

Fig. 6.18 A fine cannula inserted through a limbal puncture wound in the anterior chamber

the grey-blue limbal tissue meets the white sclera. This corresponds to the position of Schwalbe's line. (See pages 23–5 for a description of the anatomy of the limbal area). If the surgeon has some doubt as to the landmarks and the exact place from where to remove this tissue, it is better to be more forward (anterior) in the cornea than back (posterior) in the sclera. An incision which is too far back is likely to damage the ciliary body or the base of the iris where the circular artery lies. This will cause bleeding into the eye at this stage or later on when the iridectomy is performed. Removing this block of tissue nicely and neatly is probably the hardest part of the operation. The assistant should retract forwards the superficial scleral flap. Now mark out the edges of this deep block with gentle cuts which do not perforate into the eye. There are three different ways of excising this block of trabecular tissue:

A Using a knife only.

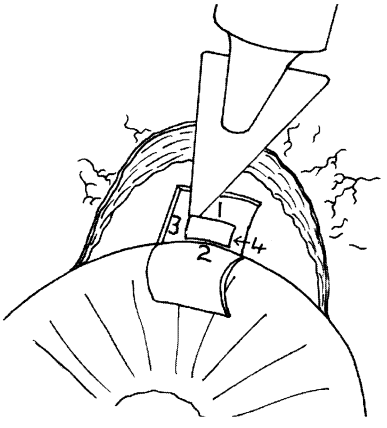

Fig. 6.19 The position of the deep block of corneo-scleral tissue to be excised, and cutting through into the anterior chamber using a knife. For an explanation of the numbers see the text on page 198.

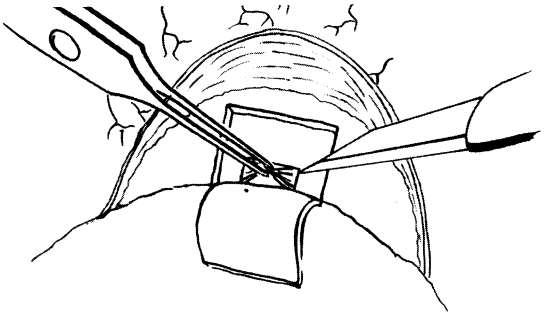

Fig. 6.20 Excising the deep corneo-scleral tissue with a knife

This is the recommended method for most situations.

- Complete the posterior horizontal incision into the eye (fig. 6.19-1). There will be a small leak of aqueous and the base of the iris will plug the incision.
- Complete the anterior horizontal incision into the eye (fig. 6.19-2). Then grasp this bridge of tissue between the two incisions with toothed forceps and lift it upwards away from the eye (fig. 6.20).
- Complete one radial incision, (fig. 6.19-3) then by lifting the block of tissue excised on three sides any remaining attachments where the anterior and posterior cuts are not complete can be divided. Finally the block is removed by cutting along its fourth side (fig. 6.19-4).
- The advantages of this method is that no instrument enters the eye to risk damaging the iris or lens, and it only requires a razor blade fragment or a similar sharp knife blade and a pair of fine toothed forceps. There is no need to use fine Vannas scissors or a fine punch both of which easily become blunt.

B Using a knife and Vannas scissors.

- Complete the two radial cuts down into the anterior chamber so there is a small leak of aqueous (fig. 6.21a).
- Insert one blade of Vannas scissors into the eye and cut across to join the anterior ends of the two radial cuts (fig. 6.21b). Lift this piece of tissue dissected on 3 sides backwards and complete the posterior cut with scissors (fig. 6.21c).

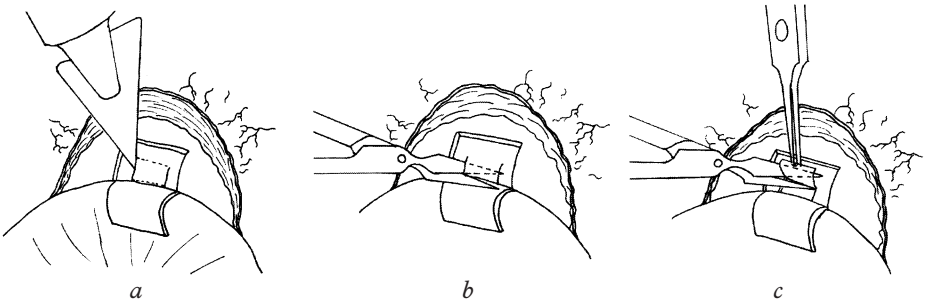

Fig. 6.21 Excising the deep corneo-scleral tissue with a knife and Vannas scissors

- The advantage of this method is that the position of the posterior cut can be seen and is not made "blind".

C Using a Corneo-scleral punch, usually a "Kelly" punch.

This is probably the easiest method if a fine sharp punch is available.
Only the anterior incision into the eye is made, (The incision labelled "2" in fig. 6.19). The tip of the punch is then inserted into the incision and a small piece of sclera punched out. Make sure that the punch is at right angles to the surface of the eye, so it cuts through all layers of the sclera

8. *The peripheral iridectomy* A portion of peripheral iris is now excised directly under the trabeculectomy hole. The iris may already have prolapsed through this hole or it may be necessary to lift it out of the eye. Grasp the iris with fine iris forceps, and excise a segment with de Wecker's scissors (fig. 6.22). Take care not to cut into the extreme root of the iris or the ciliary body both of which will bleed. Also take care not to touch the surface of the lens with the forceps.

   Particular care must be taken with the iridectomy if the operation is for congenital glaucoma. The fibres of the suspensory ligament of the lens are stretched and very weak in these patients, and can easily rupture when the iridectomy is done. The result is that vitreous will come into the wound and the operation fails. In these patients it is best to do the iridectomy well away from the base or root of the iris and more towards the pupil margin.

9. *Suturing the sclera* Close the superficial scleral flap with two fine sutures at the corners (fig. 6.23). 8"0" virgin silk, or polyglactin (vicryl), or 9 or 10"0" monofilament nylon may be used. Nylon is probably the better suture as it will not provoke a tissue reaction. Make sure the knots and stitch ends are not sticking up, and are on the side of the incision furthest from the cornea The

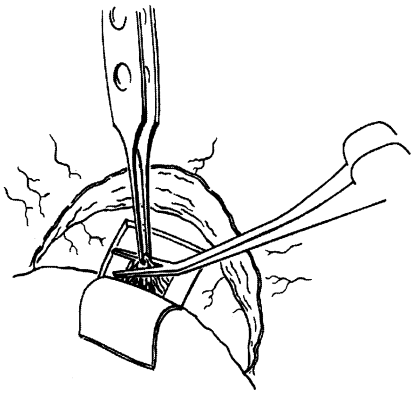

Fig. 6.22 The iridectomy

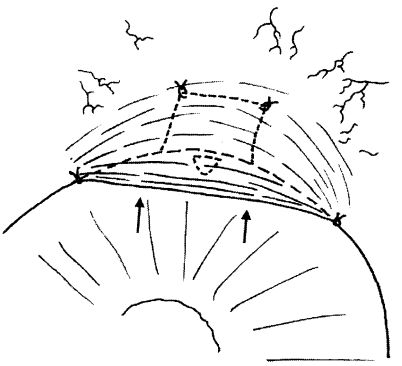

Fig. 6.23 Closure of the sclera and conjunctiva. It is very important that the conjunctiva presses tightly down against the corneal margin where shown with arrows so that aqueous does not leak out from the wound.

knot of 10"0" nylon suture can be buried in the wound. These sutures should not be too tight because the aqueous fluid will need to drain out of the anterior chamber, through the incision in the superficial sclera and under the conjunctival flap. It is helpful to test that the aqueous can drain through the wound by inserting a fine cannula on a 2 ml syringe with Ringer's solution through the limbal puncture wound made at step 6. Gentle pressure on the syringe should allow fluid to come out through the scleral incision.

10. *Suturing the conjunctiva* Suturing the conjunctiva correctly and tightly is also a critically important part of the operation. By contrast to the scleral incision which needs to leak a little, the conjunctival incision needs to be watertight so that the aqueous does not leak out of the subconjunctival space at all. The conjunctiva is closed by pulling it down and suturing it at the two corners (see fig. 6.23). First the superior rectus suture should be loosened or removed at this stage to enable the conjunctiva to be brought down more easily. **It is extremely important that the conjunctiva is anchored very tightly at the corners and under slight tension, so that it presses closely on the cornea. In this way the aqueous will not leak out under the edge of the conjunctival flap, or from the sides.**

    If virgin silk or vicryl is used to close the conjunctiva, the knot is probably best placed on the surface of the eye. A bite of limbal tissue is taken so the point of the needle enters the limbus at point A in fig. 6. 24, and emerges at the edge of the incision. A bite of the conjunctiva is then taken with the needle emerging at point B. When this suture is tied it will pull the flap of conjunctiva down over the cornea.

    If nylon is used to close the conjunctiva, it is best to have the knot buried, otherwise the hard knot will cause quite a lot of irritation. To do this the tip of the needle is passed into the edge of the incision to emerge from the limbus at point A in fig. 6.25. The needle then enters the conjunctiva at point B to emerge under the conjunctiva. When this suture is tied the knot will automatically be buried in the wound.

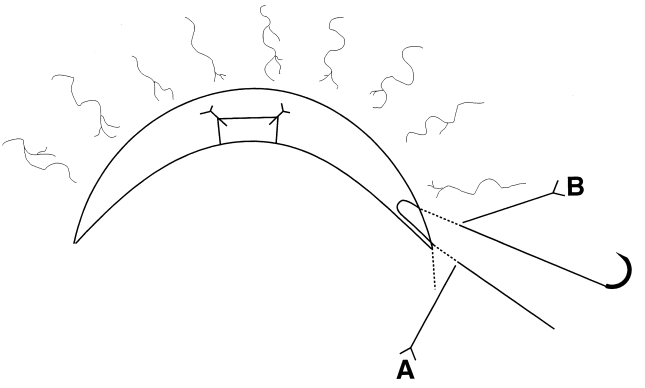

Fig. 6.24 Closing the conjunctiva with a virgin silk or Vicryl suture

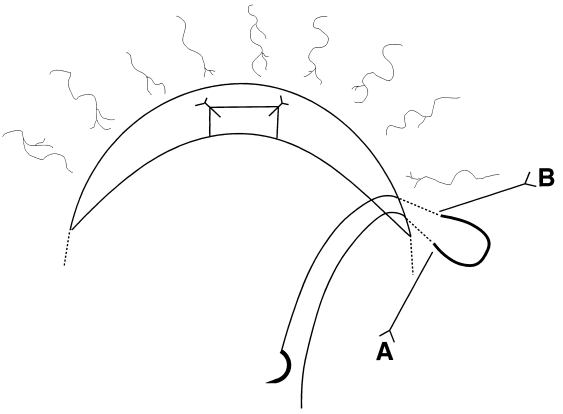

Fig. 6.25 Closing the conjunctiva with a nylon suture

When the two sutures at each end of the wound have been tied, the edge of the conjunctiva should be tight against the upper corneal margin as shown in fig. 6.23. If it is not, one or both sutures should be replaced and reinserted so as to take a bigger bite of the conjunctiva.

Finally the wound should be tested to confirm that it is watertight. The fine cannula and syringe should again be inserted through the puncture wound in the anterior chamber and fluid injected into the anterior chamber. This time fluid should emerge through the scleral incision, but should balloon up under the conjunctiva if the conjunctival wound is watertight. If the conjunctival wound leaks, then either extra sutures must be applied or the sutures re-adjusted until the wound is watertight.

Limbus based conjunctival flap

The operation described above creates a fornix based conjunctival flap with the incision in the conjunctiva at the limbus. In some circumstances a limbus based conjunctival flap may be made with the incision in the conjunctiva towards the fornix. there may be various reasons for this.

- Surgeon's preference. Some surgeons prefer this technique, because the conjunctival wound is further from the trabeculectomy site.
- Excessive conjunctival scarring at the limbus. If the conjunctiva is very scarred, the dissection will be very difficult either way but a limbus based flap may be easier.
- The use of anti-metabolite solutions (see pages 208–10). If these are being used a limbus based flap may have less complications.

To make a limbus based flap the eye is rotated downwards with a superior rectus or corneal fixation suture as described in step 1 above. A conjunctival incision is then made about 7 mm from the limbus (fig. 6.26). The edge of the conjunctiva is then lifted up with non-toothed forceps, and the spring scissors used to dissect just under the surface of the conjunctiva towards the limbus (fig. 6.27). This dissection

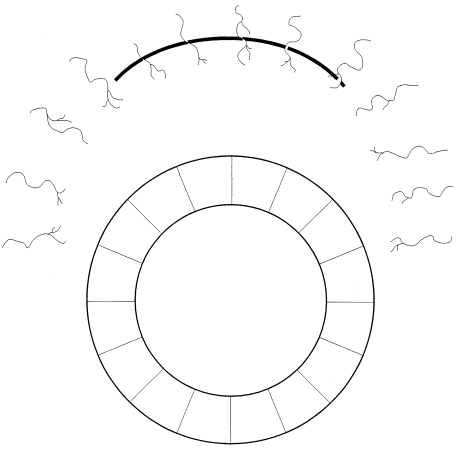

Fig. 6.26 The position of the conjunctival incision for a limbus-based conjunctival flap

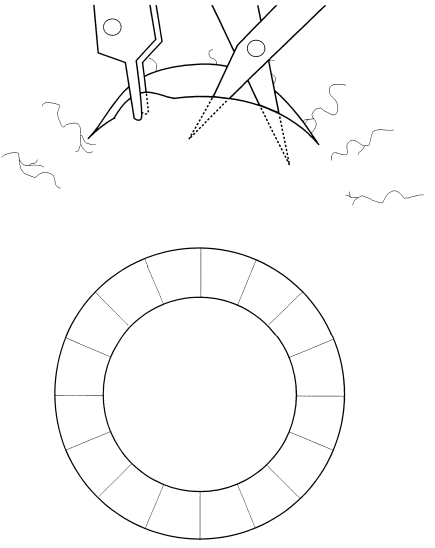

Fig. 6.27 Dissecting the limbus based conjunctival flap

is made easier if the conjunctiva is kept taut and stretched by lifting it up and pulling it back with the forceps. Take very great care not to make a hole in the conjunctiva. It is essential that the flap is intact and doesn't have hole in it. Once the dissection has reached the limbus then Tenon's capsule is separated from its insertion into the sclera about 2–3 mm from the limbus.

Step 4 to 9 are then performed as already described. The conjunctival incision is then sutured with interrupted or a continuous stitch, and the wound tested to make sure that it is watertight.

Scheie's operation

This is an easier operation and is satisfactory, but the post operative complication rate is higher, especially from excessive drainage in the early post operative period. It is only recommended if the surgeon does not have an operating microscope.

Principle:

A drainage pathway is made out of the eye by cauterising the edge of an incision into the eye. This causes the sclera to shrink and leaves a permanent fistula.

Method:

1. Dissect a flap of conjunctiva just as described for a trabeculectomy. Mark out a 3–4 mm incision line at the posterior part of the limbus, and apply very light cautery to blanch the superficial vessels.
2. With a scalpel or razor blade fragment, make an incision through half the depth of the sclera, making sure it does not penetrate to the anterior chamber. Then apply cautery to the posterior edge of the wound along its whole length

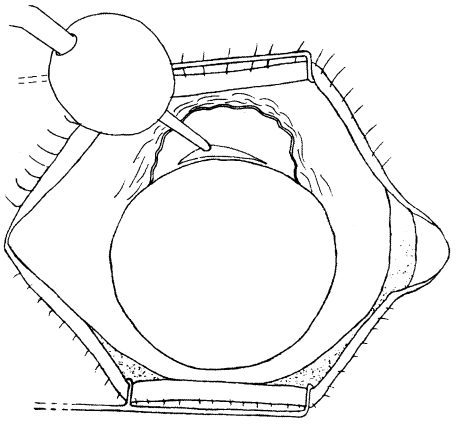

Fig. 6.28

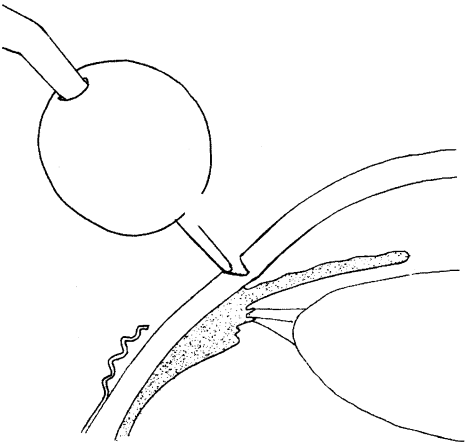

Fig. 6.29

Fig. 6.28 and *6.29* To show cautery to the posterior lip of the wound. Take great care not to cauterise the anterior lip of the wound.

(figs. 6.28 and 29). The cautery should be strong enough to make the sclera shrink and cause the wound to gape a little without excessive charring. If possible cut a little deeper into the sclera, and apply cautery again to the posterior edge of the wound. The cautery should not be applied to the anterior edge of the wound.

3. Enter the eye along the whole length of the wound. Once the anterior chamber is entered, further cautery cannot be done because the aqueous will leak and conduct away the heat.
4. Carry out a peripheral iridectomy as described for a trabeculectomy.
5. Secure the conjunctival flap very tightly with sutures at the 2 corners just as for a trabeculectomy, and making sure that the incision is tightly covered with the conjunctival flap.

Post operative care

- *Mydriatics*. These should be applied at the end of the operation and continued for at least a week (Atropine 1% daily or Cyclopentolate 1% twice daily are used). Mydriatics help to prevent post operative uveitis and adhesions forming between the iris and the lens. They also help the anterior chamber to deepen by relaxing the ciliary muscle. If there are post operative complications, they should be used for longer.
- *Topical steroids and antibiotics*. These should also be applied at the end of the operation and must be continued regularly, four times (or more often) a day, for at least a month. The purpose of the steroids is to prevent post operative uveitis and also to suppress fibrosis and scarring which occurs around the drainage bleb. Because some degree of postoperative fibrosis is such a common

problem, many surgeons would advise using topical steroids for 6 to 8 weeks. The antibiotics are to prevent infection.

- *Padding*. The eye should be firmly padded for one day. Provided the anterior chamber is fully or even partly formed no further padding is needed (see below).
- The eye should be carefully examined after a month to make sure that the drainage bleb is well formed and the intraocular pressure controlled.
- *Suture removal*. If the conjunctival sutures have not fallen out after a month, it is best to remove them, especially if they are causing any irritation. After drainage operations there is always the slight risk that bacteria will enter the eye by the same route that the aqueous drains out of it, and this risk is increased if a foreign body like a piece of suture is present.

Post operative complications

These can be divided into early complications – within the first two weeks of surgery, and delayed complications – appearing a month or even some years post operatively.

Early complications

1. Delayed reformation of the anterior chamber (see plates 18–21)

This is the commonest post operative complication. It occurs to some degree in many patients because the aqueous at first drains too rapidly out of the eye. It is acceptable for the anterior chamber to be shallow on the first post-operative day, and gradually reform over the next 3 to 4 days.

If the aqueous is draining too fast, the anterior chamber will not reform at all and the eye becomes soft. A soft eye causes protein exudate to leak from the choroidal vessels, and accumulate in the supra choroidal space. This fills up the space in the rigid sclera, which further delays the anterior chamber from reforming. Such accumulations are called choroidal detachments and can be seen with an ophthalmoscope. If the anterior chamber remains flat for a long time (a week or more), further problems may develop. Firstly a cataract may form quite rapidly. Secondly, when the fluid circulation in the eye eventually recovers, the normal drainage pathway into the trabecular meshwork will be completely closed and the drainage pathway created by the operation may also seal off, so that the operation fails. *Making sure that the conjunctival wound is watertight at the end of the operation is the best way of avoiding all these complications*.

Management:

Instill fluorescein drops into the conjunctival sac to see if there is any aqueous leak seeping from the wound (see plates 3 and 4). Try to decide if the anterior chamber is just shallow, or completely absent with the anterior surface of the lens touching the back of the cornea. This is easy to decide with a slit lamp but otherwise quite difficult.

Apply topical treatment, mydriatics and steroids and antibiotics, and then tightly cover the eye with a firm pad and bandage and leave it for one day. Examine the eye daily, and as long as the anterior chamber remains shallow or is gradually reforming, continue to treat with daily medication and a pad and bandage. If available a *bandage soft contact lens* works better than padding the eye. These lenses are soft and very thin and have a large diameter of 14 mm. They will press on the conjunctiva and help to seal a small leak. They can be left in the eye for a week but should then be removed.

If the anterior chamber appears to be completely flat for 2 days or more, surgical treatment is advised as follows:

1. If a leak of aqueous from the conjunctiva can be identified, try to close it by suturing the conjunctiva more tightly. Reapply a pad and bandage and wait for a day or two to see if the anterior chamber reforms.
2. If no obvious aqueous leak can be demonstrated, then reform the anterior chamber with air. (If they are available, visco-elastic fluids like sodium hyaluronate are better than air). Make a small puncture wound at the limbus into the anterior chamber with a sharp hypodermic needle, and inject air into the anterior chamber. This is quite a difficult manoeuvre because the anterior chamber is flat, and therefore it is easy to puncture the iris or the lens with the tip of the needle. If the air immediately leaks out of the anterior chamber this may demonstrate a hole in the conjunctiva which needs closing.
3. Some people also advise draining the choroidal effusion through a small radial incision in the sclera about 5 mm from the limbus, usually in the infero-temporal quadrant. The protein rich choroidal effusion which is coloured yellow will drain out, and more air can then be inserted into the anterior chamber. This may be difficult to do and is often not necessary.

   (Steps 1 and 2 can be performed using just topical anaesthetic drops and a small sub conjunctival injection of local anaesthetic in a relaxed patient. Step 3 requires a full retrobulbar block, as does Step 1 and 2 in a nervous patient. A facial block is advisable for all patients.)

2. Failure of the aqueous to drain

This is the second most common post-operative problem. There will be no bleb of aqueous under the conjunctiva, the anterior chamber will be fully formed and the intra ocular pressure remain high. Ther are various reasons for the drainage of aqueous to fail. The trabeculectomy hole may be blocked with the iris or with fibrin and blood. The scleral sutures may be so tight that the aqueous cannot drain through the wound.

Management

Ther is no harm in waiting for one day to see if the aqueous will start draining spontaneously. If there is still no drainage *ocular massage* should be done. The best way of doing this is to apply topical anaesthetic drops to the conjunctiva and press on the sclera just above the incision in the sclera with a glass rod or a blunt instrument. This will raise the pressure in the eye and also help to open up the scleral incision. In this way the aqueous is forced out of the eye and usually a

drainage bleb will form. Often the aqueous will then continue to drain by itself or the massage may be repeated. Sometimes it may be helpful to get the patient to massage their own eye once or twice a day. This is done by looking down, shutting the eyelid, placing two fingers on the eyeball and pressing with first one finger and then the other.

If massage fails, the sutures in the scleral flap should be cut. For those with the luxury of an argon laser, this can be done by focussing the laser beam with a glass rod on to the nylon suture. Alternatively the sutures can be cut by passing a hypodermic needle through the conjunctival wound, under the conjunctiva and using the sharp edge of the tip of the needle to cut the suture.

The use of releasable sutures

This technique has developed in the last few years as a way of having better postoperative control of the intraocular pressure. One or more of the sutures on the scleral flap are tied very tightly so as to lessen the risk of excessive drainage, but by a method so that they can be released very easily if there is inadequate drainage. Different suturing techniques have been described , they are all slightly complex and some good fine instruments and the patient's co-operation is needed if they have to be removed. One method is shown in fig. 6.30. Monofilament 10 "0" nylon must be used. The needle enters the sclera at "A" to emerge in the peripheral cornea at "B". It re-enters through the cornea at "C" to come out of the superficial scleral flap at "D". It then passes across and through the wound edge from "E" to "F". The knot is tied by winding the suture beyond "F" at least three times round a suture tying forcep and then grasping the loop between "D" and "E" with the tip of the suture forcep. This is pulled very tight to close the wound between "E" and "F" and also tighten the small loop of the suture lying on the cornea between "B"

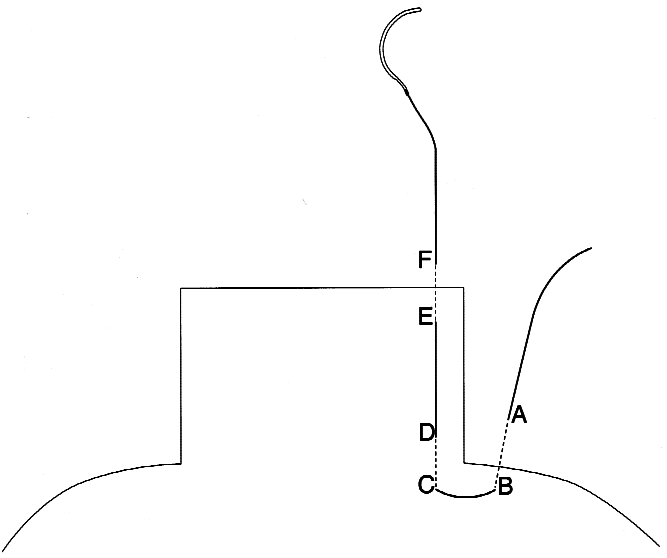

Fig. 6.30 To show how a releasable suture is inserted.

and "C". The needle is cut off and the ends at "A" and "F" are left under the conjunctiva. If postoperatively the aqueous is leaking through the scleral wound then the suture is left in position. If there is no drainage and the pressure is high then topical anaesthetic drops can be applied, and the loop of suture on the cornea between "B" and "C" is grasped and pulled. This will undo the slip knot and the whole stitch will come out.

3. Hyphaema

A small hyphaema is quite common. It usually occurs because the iridectomy has been done too near the circular artery at the root of the iris. It will absorb in time without any serious effect.

4. Malignant glaucoma

Malignant glaucoma and its treatment is discussed on page 168. It is fortunately extremely rare. The vitrectomy probe or needle should be inserted through the pars plana and a small amount of vitreous aspirated. The anterior chamber should then be filled through a limbal puncture wound.

Delayed complications

1. Inflammation and fibrosis around the drainage bleb

Inflammation may appear around the drainage bleb about 2 weeks post operatively, and this inflammation may persist for some weeks. During this stage the intraocular pressure is often raised. This inflammation may resolve and the intraocular pressure fall, with the formation of a good drainage bleb subconjunctivally. Sometimes the inflammation may progress to form a fibrous scar which prevents the aqueous leaving the eye, so there is no drainage bleb or a thick wall of scar tissue around it. The intraocular pressure remains permanently raised and the operation will fail. This excessive inflammatory reaction causing the operation to fail is more common in certain circumstances:

- If patients have received drops for glaucoma, especially those who have been treated for a long time or those given adrenaline or similar drugs.
- Patients who have had previous surgery especially involving the conjunctiva.
- Young patients.
- Patients who are Afro-Caribbean seem to have a more marked postoperative inflammatory response.

During the stage of inflammation it is important to continue with regular and intensive topical steroid treatment until the inflammation subsides. If there are signs of inflammation around the drainage bleb it is best to give topical steroids every two hours for up to two months. Occasionally the trabeculectomy appears to be a complete success, with a good drainage bleb, but the intraocular pressure remains high. This may be a complication of the steroid drops, because topical steroids can occasionally cause raised intraocular pressure.

Medical treatment to lower the intraocular pressure (Timolol, Acetazolamide etc.) may also be required during this period.

Preventing postoperative fibrosis and failure of the drainage bleb

Good surgical technique will greatly reduce the risk post-operative fibrosis. The following details are particularly important:

- Haemostasis so there is no subconjunctival bleeding
- No loose sutures or stitch ends to cause inflammation
- A watertight conjunctival wound to prevent hypotony

Intensive postoperative topical steroids as described above also help to prevent postoperative fibrosis.

A more effective method is the use of antimetabolite or cytotoxic drugs which inhibit the multiplication of the fibroblasts. These are the cells which make the fibrous tissue which causes the bleb to fail. Two different drugs are recommended, 5-fluorouracil, and mitomycin C. There is still some uncertainty as to what exactly is the best way to deliver the drugs and what is the correct dose.

5-Fluorouracil (usually supplied in ampoules of 250 mgs in 10 ml of water). This can be applied during the operation. A small eye swab is soaked in this solution and tucked under the conjunctival flap (see fig. 6.31). This is done *after* the conjunctiva has been dissected off the sclera but *before* any incision has been made in the sclera (between step 3 and step 4 on pages 195–6). In this way the drug inhibits the fibroblasts under the conjunctiva and on the surface of the sclera. The swab is left in place for five minutes, although some surgeons recommend replacing it with a fresh swab every minute. Finally the wound should be thoroughly irrigated with saline solution to wash away any residual chemical.

There seem to be very few complications from giving 5-fluorouracil in this way. Some surgeons are advising that it should be given routinely in all trabeculectomies.

Alternatively, 5-fluorouracil may be given postoperatively as subconjunctival injections of 5 mgs daily for one week and then on alternate days for one week. Giving multiple injections like this may obviously be difficult to arrange, and a full course may not be possible. These injections should not be given too close to the bleb site.

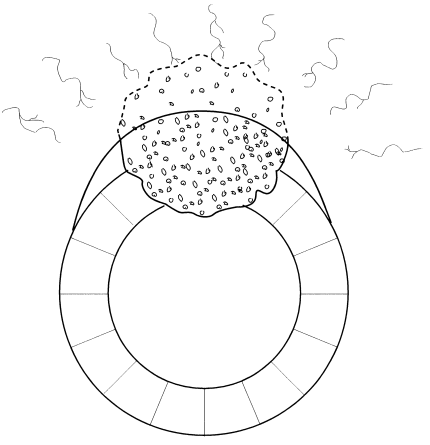

Fig. 6.31 To show the position of a small sponge soaked in 5-fluorouracil

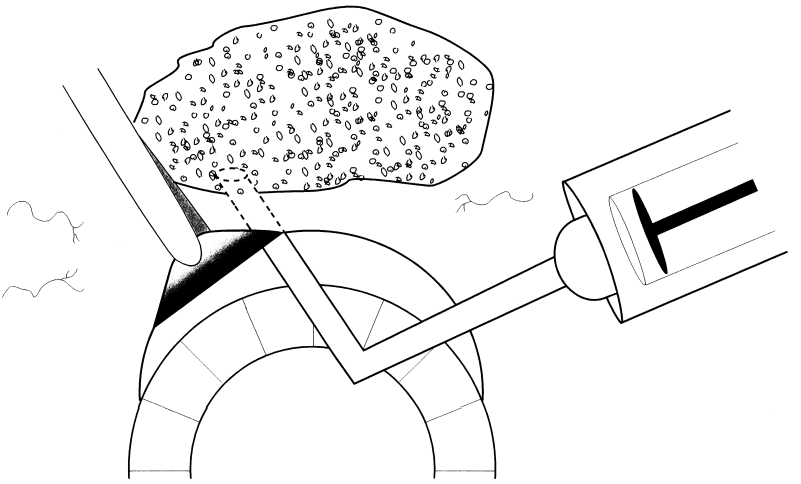

Fig. 6.32 To show the position of a small sponge soaked in mitomycin and how to avoid the mitomycin coming into contact with the edge of the conjunctival wound

Mitomycin C. 1mg of mitomycin is diluted in 5 ml of water (making a solution of 0.2 mg per ml). Mitomycin C is a more potent drug than 5-fluorouracil and has a stronger effect on inhibiting cells which are dividing and multiplying. Therefore great care must be taken so that the solution does not touch the edge of the conjunctival wound. If it does it can prevent the wound healing so that there is a permanent leakage of aqueous through the conjunctival wound. Therefore the best way of applying it is as follows:

- First place a very small *dry* sponge under the conjunctiva, but place this high up so it is not near the edge of the wound.
- Draw up a very small amount of mitomycin solution in a 1 or 2 ml syringe attached to a very fine cannula.
- Lift up the edge of the conjunctival wound and inject the mitomycin directly on to the swab. (fig. 6.32)
- Make sure that the solution does not spill over on to the edge of the wound but try to treat as large an area as possible.
- After 5 minutes remove the swab and irrigate the wound thoroughly with saline.
- Because mitomycin is such a strong drug, some surgeons advise that it should always be used with a limbal based conjunctival flap and not a fornix based flap. In this way even if there is some delayed wound healing ,this will not occur right over the site of the trabeculectomy. Even then the surgeon should place the sponge and the mitomycin so that it does not touch the cut edges of the conjunctiva.

Recommendations for preventing fibrosis and failure of the drainage bleb

- *Low risk cases*. – Carry out a routine trabeculectomy and give routine postoperative topical steroids.
- *Moderate risk cases*, for example African patients, young patients or patients who have had several years of medical treatment. – Apply 5 fluorouracil on a sponge at the time of the operation. It may also be given as postoperative sub conjunctival injections, if there is evidence of marked postoperative inflammation.
- *High risk cases*, for example patients who have had an unsuccessful previous operation or who have chronic uveitis – Apply mitomycin C on a sponge at the time of the operation, and if necessary postoperative sub-conjunctival injections of 5-fluorouracil as well

Future prospects. Quite a lot of active research is being done at present to try to modify the postoperative reaction in the conjunctiva. This would enable a trabeculectomy to be a more reliable operation and lessen the risk of failure or excessive drainage.

A single dose of **beta radiation** (750 centigray) from a strontium 90 applicator placed on the conjunctiva over the trabeculectomy site immediately postoperatively will suppress post-operative fibrosis. This is probably safe and effective, but strontium 90 applicators are not widely available at present.

There is also research into antibodies which can prevent fibroblast activity.

Encysted bleb

Sometimes there is a good drainage bleb but a fibrous capsule develops around it so that the aqueous cannot get absorbed from the subconjunctival tissues and the intraocular pressure remains high. This situation may be helped by a *needling of the bleb*.

- Apply plenty of topical anaesthetic drops, and povidone iodine to sterilise the conjunctiva.
- Insert a fine hypodermic needle under the conjunctiva about 4 mm away from the bleb, inject some lignocaine with adrenaline to cause the conjunctiva to balloon a little, and slowly advance the tip of the needle through the fibrous wall of the bleb and out the other side, but without puncturing the conjunctiva itself. Take great care to avoid any blood vessels and not to cause a sub conjunctival haemorrhage.
- Inject 5 mgm of sub-conjunctival 5-fluorouracil well clear of the bleb.

2. Cataract

There is an increased risk of developing cataract after a drainage operation. A cataract may develop some years later, even if the surgery is completely uncomplicated. If there are complications at the time of operation or post operatively, then cataract formation is more likely and may develop quite quickly. The cataract should be treated surgically just as any other cataract, but a corneal incision avoiding the drainage bleb is recommended. After trabeculectomy extracapsular and not intracapsular cataract extraction should be performed. This prevents the vitreous from becoming trapped in the drainage site.

3. Endophthalmitis

After a drainage operation, aqueous passes from the eye into the sub-conjunctival space. There is always a risk that infection will pass in the opposite direction, from the conjunctiva into the eye. The infection may just reach the drainage bleb, sometimes called "bleb-itis" with pus and inflammation around the drainage bleb (see plate 17). It may spread further into the eye causing endophthalmitis. (See page 163 and plates 9 and 10 for a description). Any episode of unexplained inflammation or iritis in an eye after a drainage operation might signify an intraocular infection needing urgent treatment.

If the infection is just in the bleb then intensive topical, sub conjunctival and systemic antibiotics should be given (see page 167). If there is an endophthalmitis, then intravitreous antibiotics should be given (see page 164–6).

4. Excessive drainage of aqueous and hypotony

Excessive drainage of aqueous causing a very low intraocular pressure (hypotony) is quite common in the first few days after the operation. It nearly always recovers by itself. If a very large drainage bleb and a very soft eye persist for more than a few weeks, a long mattress suture of 10"0" nylon may make the drainage bleb smaller and restore the intraocular pressure to normal levels (fig. 6.33). These may be placed on one side or both sides of the bleb.

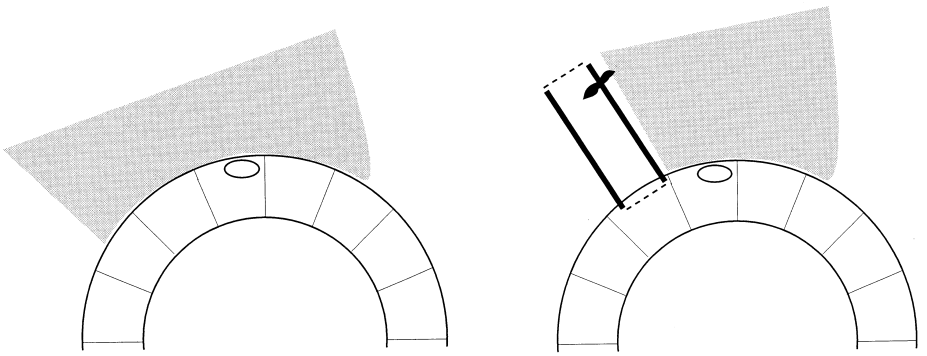

Fig. 6.33 A mattress nylon suture placed to reduce the size of the drainage bleb if it is too large

Note: If the reader is uncertain of the significance of the relative afferent pupil defect or how to test for it, please see "Eye Disease in Hot Climates" 4th edition published by Elsevier India or available from the International Centre for Eye Health (for address see page 324).