52 Eye injury

52.1 Introduction

Eye surgery is an area which many a doctor finds daunting. Whilst all operations inside the eye require meticulous expertise, you should be able to repair surrounding structures. Even if the eye seems to be hopelessly injured, there is much that you can do to preserve some useful sight in it.

You may see blunt injuries which leave the cornea and sclera intact, and penetrating injuries which damage the interior of the globe.
A blunt injury, such as that from a fist, may cause serious internal lesions, including bleeding, with few external signs.
A penetrating eye injury is always serious, but its cause differs from place to place; in rural areas causes are often from thorns, sticks or branches or in young children during play. In town, from assault or work-related accidents, and in war from missiles.
Fire burns may affect the eyelids or cornea; blast injuries may cause a myriad of problems:
(1) conjunctival or subconjunctival damage,
(2) hyphaema,
(3) lens dislocation & cataract,
(4) vitreous & retinal haemorrhage & detachment
(5) optic nerve injury,
(6) air embolism causing blindness,
(7) retrobulbar haematoma.

Prevention is not always feasible, but try to encourage the wearing of goggles at work (if sparks or splinters are flying around) & seat belts in cars. *An ounce of prevention is better than a pound of cure!*

Patients will often be anxious about visual loss. So always start by testing (and recording) the visual acuity. Make sure a victim knows what has happened, understands the purpose of treatment and you mention the prognosis for subsequent sight.

An injured eye is always an emergency, but it is rarely immediately fatal. After the necessary emergency treatment, you usually have 2-3days to refer the patient to an eye centre. So, if an operation is necessary, *make sure of the diagnosis and that both you & the patient know exactly what to do.*

JAMES (8 years) was referred with a swollen eye and a diagnosis made elsewhere of rupture of the globe of the eye. the visual acuity was tested and found to be normal. Examination of the upper conjunctival fornix showed the presence of a piece of wood.
LESSON Always test the visual acuity. In this case, the original diagnosis *could not possibly be correct*.

MANAGEMENT OF AN INJURED EYE
As in any injury, start with ABC (41.1)

Many times, you may be able to deal with the problem without incurring the patient a long, difficult & expensive trip of referral.

Take as careful a HISTORY as you can.
Pain will make a patient keep the injured eye shut.
LA will make it easier to examine.
Wash out the eye with copious clean water.
Gently pick out any loose material
Leave an embedded foreign body in situ at first.

Retract the lower lid and instil 2 drops of LA eyedrops (tetracaine hydrochloride 1%, proparacaine hydrochloride 0.5%, proxymetacaine hydrochloride 0.5%). You may have to make repeat instillations before anaesthesia is effective.
CAUTION! (1) *Don't put ointments straight away into a patient's eye;* they will make it difficult to examine later. (2) Topical anaesthetics, dyes, and drugs must be sterile; bottles can readily become infected, especially with *Pseudomonas* spp. *Don't store opened bottles >3wks*. (3) *Don't let a patient take home LA eyedrops;* this may too easily allow injury to the anaesthetized cornea.

EXAMINATION OF AN INJURED EYE
***Always start by examining the visual acuity of both eyes*,** the normal one first. Perform your examination in good light, using whatever means of magnification you have, with both you and the patient in a comfortable position.

If the eye does not open spontaneously, gently open the lower lid by pulling down the skin over the zygomatic arch. Instil LA eye drops, which will probably relieve pain enough to allow spontaneous opening of the eyes.

If the eye remains shut, insert a Desmarre's retractor gently under the upper lid, and lift it upwards away from the globe by pressing on the upper orbit.
N.B. You can use a retractor made from 2 bent and sterilized paper clips.

If the eye still remains shut, you may have to examine it under GA.
CAUTION! Avoid pressure, either by squeezing the eye, or by letting the patient rub the eye. This might cause irreparable damage!

If the globe is perforated, *pressure may squeeze its contents out!* Temporarily cover the eye with a sterile dressing. Check for anti-tetanus coverage.

SIGNS OF EYE INJURY

(1) Examine the eyelids carefully. A tiny laceration may be the opening of a track which penetrates the globe (52-9).
Remember to remove contact lenses if present!
(2) Examine the conjunctiva for haemorrhage, foreign bodies, or tears.
(3) Note the depth and clarity of the anterior chamber. Compare the size, shape, and light reaction of the pupils.
(4) Note the movements of the eyes.
Check if the globe is intact, then examine the conjunctival fornices & evert the upper lids (28-2).
(5) Dilate the pupils and examine the fundus with an ophthalmoscope.
(6) Examine the lens, the vitreous, and the retina for signs of haemorrhage, or retinal detachment.
(7) Examine the cornea and sclera for wounds and abrasions. Use drops of fluorescein if you suspect this.
Don't try to feel the tension in the globe, because it is easy to squeeze out its contents if it is ruptured.

If there is blood under the conjunctiva, beware:
(1) Even a very small bruise may indicate where a small foreign body has entered the sclera (52-9).
(2) Haemorrhage at the limbus is itself unimportant. It is only likely to be serious if it extends far posteriorly beyond the fornix, when it may indicate a fracture of the base of the skull (62.1).

If the anterior chamber is shallow, there is a penetrating corneal injury, which has allowed aqueous humour to leak. In severe cases, where the anterior chamber has completely emptied, the iris touches the cornea.

If the iris trembles when the eye moves, the lens may have dislocated.

If there is a greyish area in the cornea with swollen margins, it is perforated.

If a black mass of tissue bulges through the lips of a wound (52-7), the iris or choroid has prolapsed. If the wound is in the cornea, the pupil will be irregular and drawn towards it (52-6J).

If the eye feels soft, the globe has probably ruptured. The rupture is nearly always curved, parallel to the limbus, and c.5mm behind it. Feel the bony borders of the orbit. Get a skull & orbital radiograph.

ALWAYS LOOK FOR OCULAR INJURY WITH ANY WOUND NEAR THE EYE

If you can see the edge of the lens with an ophthalmoscope, and there is some visual impairment, the suspensory ligament of the lens is partly ruptured. If it is also dislodged, the intra-ocular pressure may rise. If this happens, administer acetazolamide and refer.

If the lens is completely dislocated, you may see it lying in the anterior chamber, or at the bottom of the vitreous, or it may have been extruded from the eye. There will be severe visual impairment. There may be no immediate reaction, but an inflammatory response and a secondary rise in intra-ocular pressure are common. Administer acetazolamide and refer. The lens may need to be removed.

If there is severe proptosis (53.3), there is a retrobulbar haematoma.

Even if the eye appears hopelessly injured and there is no awareness of light, *don't consider enucleation* (28-19) *or even evisceration* (28-20) *at this point*.
You must wait at least 2wks to do this, and ensure there is *no perception of light at all.* If there is any perception of even a strong light, a surprising amount of vision may return by 6 months.

ANAESTHESIA

Remember that an eye injury is a strong stimulus for vomiting. Although ketamine has had a reputation for increasing intra-orbital pressure (and intracranial pressure), this is actually not a problem especially if you add a sedative such as midazolam. If the eyes move about, use a little more drug. *Don't use a retrobulbar block*, because haemorrhage may cause globe contents to extrude if it is ruptured.

Whilst you can use LA drops for simple procedures, for anything more complex you will need GA. If you use ketamine, you need an LA block also to prevent disturbing nystagmus during the examination. *Don't use suxamethonium as it raises intra-ocular pressure.*

IMAGING

A plain radiograph will show the condition of the orbit and presence of radio-opaque foreign bodies. Get 2 views with the patient looking ahead & upwards: this will show if the foreign body is intra-ocular or not (52.9).

REFERRAL

If you have an eye surgeon to refer injured patients, this may be better for all but the simplest procedures, even if this means some days' delay.

If you decide to refer such a patient, instil antibiotic drops into the eye if there is a closed globe injury, & apply a protective dressing (28-1).

If there is an open globe injury or the journey is long, or is likely to be delayed, add chloramphenicol 500mg initially, followed by 250mg qds for 5days, and administer anti-emetics. Avoid anything that might increase the intra-ocular pressure, such as urinary retention.

FOR EYE SURGERY, YOU MUST HAVE A BRIGHT LIGHT AND GOOD MAGNIFICATION

52.2 Eyelid haematoma ('black eye')

A 'black eye' is the result of a blow by a blunt object. By itself it is not serious, but check if there is an associated head injury (51.1), a maxillofacial injury (53.1), or rupture of the globe (52.6). This may be difficult to diagnose if there is much swelling, so if you suspect this, use LA and use eyelid retractors. Mild ptosis (drooping of the eyelid) is common after a black eye. If it lasts more than a month, refer.

52.3 Eyelid, canaliculi & conjunctival injury.

SUTURING THE EYELIDS (GRADE 2.2)

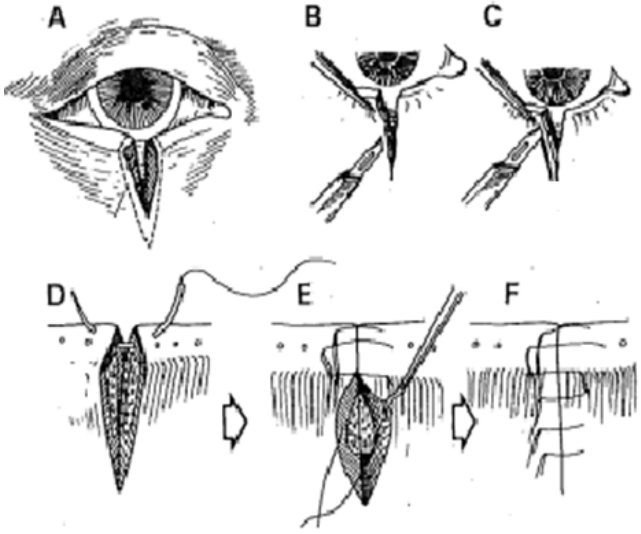

Fig. 52-1 SUTURING THE EYELIDS (GRADE 1.2**). Little tissue has been lost in this injury, so that bringing the edges of the patient's lids together is not too difficult. A, excise a 'V' of tissue. B,C, make a clean edge *taking care not to damage the cornea with the tip of your scalpel.* D,E,F, make sure you align the eyelash line carefully.** *Partly after Hill with kind permission.*

Eyelid injuries are common, and may be serious because of the danger to the eyes under them, either immediately, or later if scar tissue distorts the lids and exposes the cornea. The injury can involve part of the thickness of a lid, or its whole thickness, including its tarsal plate, sometimes with tissue loss.

To repair a torn eyelid, start by putting a stay suture in the lash line immediately behind the eyelashes. If you align the lash line correctly, it will align the other structures. The secret of success is using multiple small sutures and accurate apposition. *A common mistake is to use large instruments and coarse sutures.*

REPAIRING EYELISD TISSUE LOSS
(GRADE 2.3)

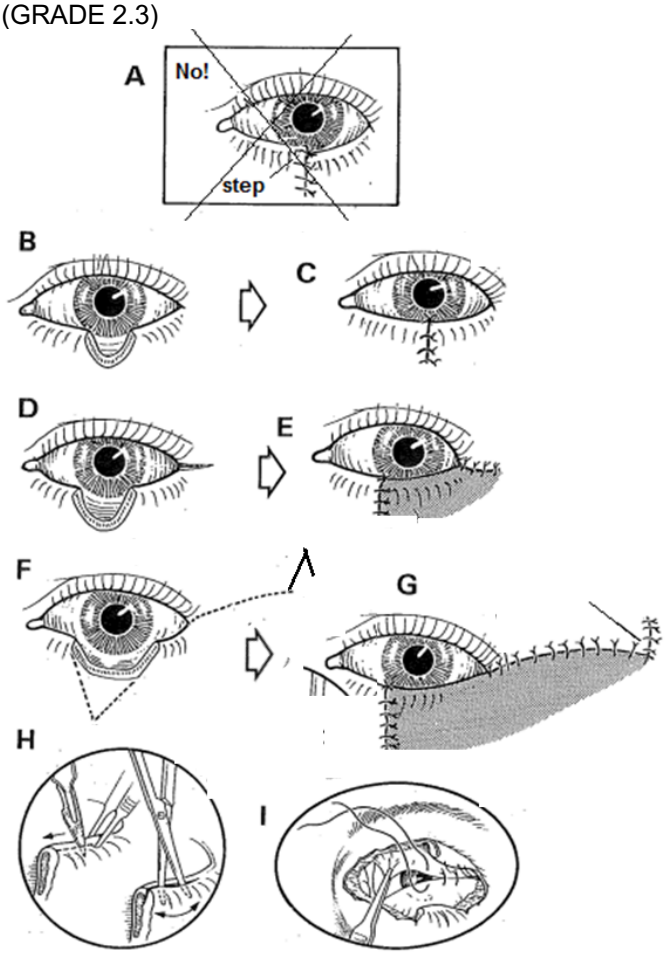

Fig. 52-2 IF THERE IS EYELID TISSUE LOSS. A, *don't create a step in the eyelid edge*. B,C, if <¼ is lost, close the wound directly. D,E, if ¼ to ⅓ is lost , make a lateral relaxing incision. F,G, if >⅓ is lost, make a long relaxing incision and undermine the cheek tissues. Make allowance for the 'dog ear' laterally. H, If both lids are lost, to cover the eye, incise the lower eyelid in the lash line & in front of the tarsus. I, if there is not enough eyelid left to cover the cornea, cover it with conjunctival flaps. *Partly after Mustardé JC, Reconstruction of eyelids. Ann Plas Surg 1983; 11(2):149-169 with kind permission.*

If there is a severe injury to the eyelids, clean them thoroughly. *Don't remove any skin, unless it is obviously dead or detached*. Use fine instruments, and 6/0 monofilament; bring the edges of the wound together with great care.

CAUTION! Always use a lid guard to protect the eyeball when repairing the eyelid. *Don't allow it to become inverted or everted.*

If the injury has involved the whole thickness of the eyelid, approximate the tarsal plate, the muscle layer and then the skin. Disregard the conjunctiva. It is stuck to the tarsal plate, and if you align this, it will align itself.

If the wound gapes, it will do so because the fibres of the *orbicularis* muscle have been cut. Use 6/0 buried absorbable to bring the edges of the muscle together, before you suture the skin.

You must ensure that the eyelids can cover the cornea. This may mean a tarsorrhaphy (28-13). **If there is not enough eyelid left for a tarsorrhaphy,** grasp the conjunctiva at the upper fornix, with forceps, pass a suture through it, bring it down, and pass it through a similar fold from the lower fornix, in the same vertical line. Use several interrupted sutures to bring a double thickness of conjunctiva across the globe (52-2I).

If the lid is greatly swollen & presentation is late, clean the wound, excise the minimum amount of tissue, administer antibiotics, and repair the lid when the swelling has subsided.

LATERAL CANTHOTOMY (GRADE 2.2)

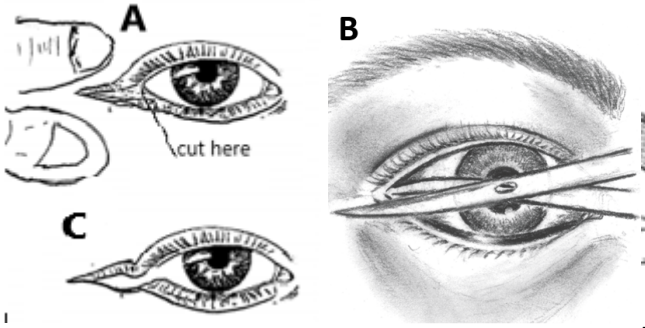

Fig. 52-3 DIVIDING THE OUTER CANTHAL LIGAMENT. A, Infiltrate LA with adrenaline into the conjunctiva & ligament of the lateral canthus, and hold the lids open. B, cut the lateral canthus down to the orbital rim the full depth of the conjunctiva, dividing the lateral canthal ligament. C, appearance of the lateral canthus after incision: the globe drastically reduces in size.

CANALICULAR INJURIES

If the canaliculus is injured, this needs microsurgical repair. Otherwise, pass a fine monofilament suture through the punctum, out through the wound and across the divided canaliculus into the lachrymal sac just below the attachment of the medial canthal ligament to the nasal bones. Suture the wound and leave the monofilament in place for 7days.

CAUTION! If you don't repair the lower canaliculus, tears will flow continuously.

CONJUNCTIVAL INJURIES

Most conjunctival lacerations will heal without suturing.

If a laceration is extensive, expose the eye with lid sutures (23-2). Dissect the conjunctiva away from the globe and search it for a perforating wound. Gently probe the wound and extend it if necessary. Suture the conjunctiva with continuous sutures of 5/0 plain absorbable.

CAUTION! (1) Sometimes a major injury is hidden under a small conjunctival wound, so probe it carefully. (2) *Don't probe around inside the eye.* Only probe to see if the sclera has been perforated.

SUTURING THE CONJUNCTIVA (GRADE 1.4)

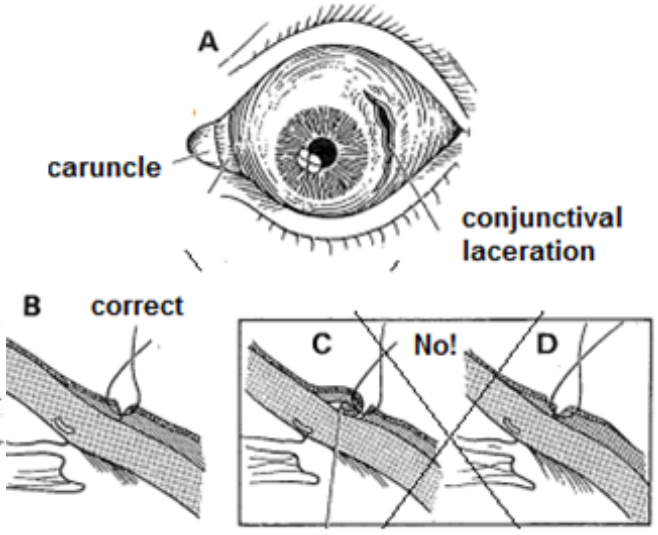

Fig. 52-4 SUTURING THE CONJUNCTIVA. *Don't suture small lacerations*. A, preserve the caruncle and the plica if you can. B, a correctly placed suture. C, if the conjunctiva is folded over like this, an inclusion cyst may develop. D, this suture will allow Tenon's capsule to herniate into the wound. *After Peyman GA, Principles & Practice of Ophthalmology, WB Saunders, London 1980 with kind permission.*

52.4 Retrobulbar haemorrhage

Bleeding behind the eye can easily result within 2h in its irreparable damage. This is in effect an acute orbital compartment syndrome. The eye is extremely painful, grossly swollen with proptosis, firm to touch, with loss of light pupillary reflexes, and paralysed. There is rapidly deteriorating vision. You will see a collection of fluid behind the white rim of the orbit easily with a bedside ultrasound.

IMMEDIATE DECOMPRESSION UNDER LA IS IMPERATIVE.

Use small straight scissors to divide the lateral canthus down to the bone of the orbital rim and to the depth of the lateral conjunctival sulcus. Protect the globe by spreading the eyelids with your index and thumb, in order to avoid a corneal abrasion or conjunctival damage (52-3). Administer 500mg acetazolamide & then 250mg every 4h x4, to lower the intra-ocular pressure.

52.5 Corneal & scleral injury

The common corneal injuries are abrasions and lacerations. Most abrasions heal in 24-48h.
The danger of an abrasion is that it may become infected, result in a corneal ulcer and may develop into endophthalmitis. Chemical & thermal injuries may only be visible after 3-4days. Wash these with copious amounts of water *in an eyewash cup or the shower.*

N.B. Alklali penetrates the cornea but acid mixes with surface proteins to produce a gel.

A corneal laceration is the most difficult eye injury that you may have to treat. If a laceration perforates the cornea, allowing the aqueous to escape, the iris may dislodge against its posterior surface, or prolapse (52-6J). If a laceration is small, and its edges are not separated, you may not need to suture it. A clean wound of the cornea heals rapidly, especially if only the epithelium is injured. If a wound is deeper, a scar is inevitable.

CORNEAL AND SCLERAL INJURIES

The eye is red and watery and the lids tightly closed. There may be ciliary injection, but the visual acuity is normal. After looking at the eye carefully, you find no foreign bodies on the surface of the cornea, or underneath the upper lid, but instead see an abrasion, which you may only find after you have stained it with fluorescein

2 CORNEAL INJURIES

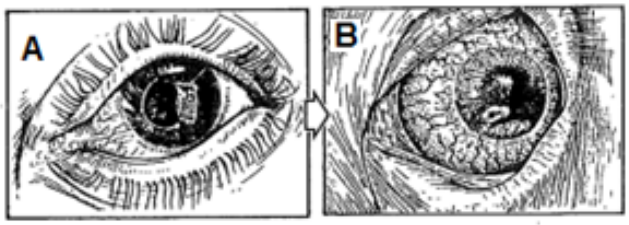

Fig. 52-5 TWO CORNEAL LESIONS. A, a corneal abrasion. B, a corneal ulcer. ***If you are not careful, an ulcer can follow an abrasion.***

If an abrasion is clean, and is only visible after staining with fluorescein, and there are no signs of infection, instil chloramphenicol eye drops and shield the eye (28.1). Check it daily, and instil chloramphenicol, until it no longer stains with fluorescein. **If the cornea becomes cloudy,** it has become infected. This is now a corneal ulcer.

CORNEAL ULCERS
There is a hazy white spot on the cornea; it may be hollowed out, or there may be a yellowish area, or pus in the anterior chamber.
The eye is painful, photophobic and red with ciliary injection. Try to send a pus swab from the ulcer for bacteriological and fungal examination. Instil atropine drops, topical broad spectrum antibiotic drops (neomycin, bacitracin, or chloramphenicol) hrly for 1-2days & then less frequently as it improves.

CORNEAL LACERATIONS (GRADE 2.5)
Corneal lacerations need repair under the operating microscope using 9/0 or 10/0 monofilament sutures. This may well be beyond your means, so try to refer them as soon as you can, instilling chloramphenicol as you wait.

If a corneal laceration is <1mm, the anterior chamber is of normal depth, there is no iris in the wound, & it retains its normal curvature, *it does not need a suture*.

If the normal curve of the cornea is angled or tented, if the anterior chamber is shallow, if the iris has prolapsed, or corneal stroma has been lost from the edge of the wound, repair it by inserting a tight horizontal mattress suture, using 9/0 monofilament for the limbus and 10/0 for other parts of the cornea. You will find this difficult task easier if you use interrupted sutures. One length of atraumatic suture material will be enough for the whole injury.

CAUTION! Don't suture the cornea with short-absorbable because the wound will take 6wks to heal.

Use a small curved cutting needle. Grasp it at its mid-point, so that the convexity of the jaws of the needle holder is towards the tip of the needle. This will give you more control.

CAUTION! Aim to bring the cut edges of the endothelium on the posterior surface of the cornea together, without actually going through it.

The way to do this is to pass the needle across the wound in its posterior ⅓.

CORNEAL & SCLERAL SUTURING

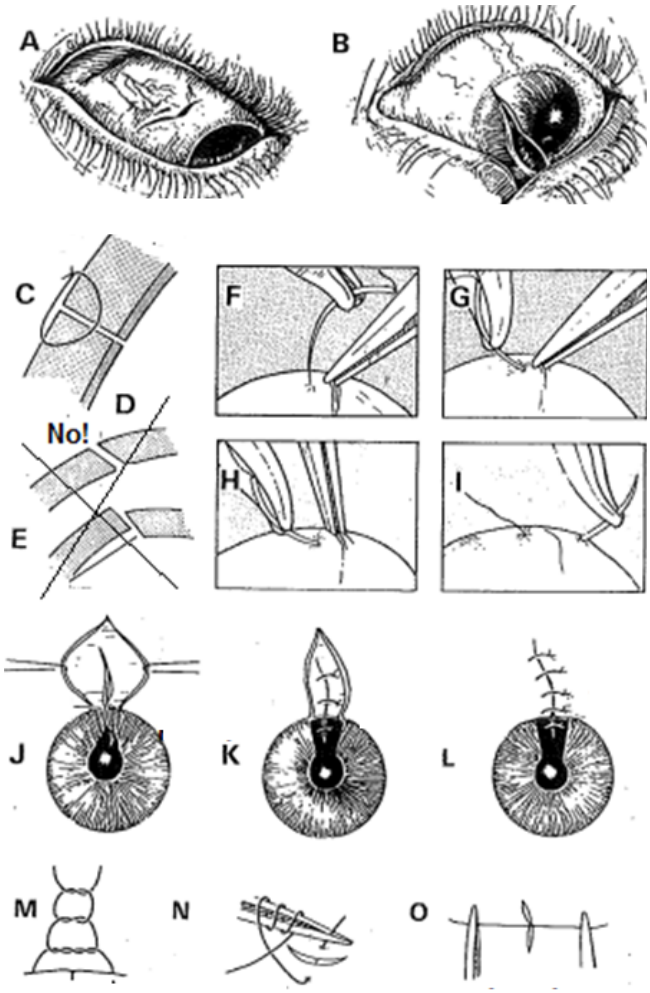

Fig. 52-6 SUTURING THE CORNEA AND SCLERA. A, a scleral laceration. B, a corneal laceration and the eyelid. C, try to make the suture cross the cornea in its posterior ⅓. It is only about 1mm thick, so this will not be easy. D, if the normal curve of the cornea is maintained, there is less need to suture. E, if it is deformed or tented, it needs suturing. The cut edges of the endothelium on the posterior surface of the cornea should be in contact. F, the needle entering at 90° to the cornea. G, the needle about to cross the wound. H, entering the other side of the wound. I, pulling out the needle. J, the conjunctiva retracted to show a wound of the cornea and sclera with prolapse of the iris. K, the prolapsed iris excised, and the cornea and sclera sutured. L, the cornea closed over the wound. M, a triple throw knot for tying 10/0 monofilament. N, wind the suture three times round the forceps. O, pulling the suture tight. *Partly after Galbraith JEK, Basic Eye Surgery, Manual for Surgeons in Developing Countries, Churchill Livingstone, 1979 with kind permission.*

The whole thickness of the cornea is maximum 0.7mm, so that this will not be easy. *If your sutures are too superficial they will pull out; if they are too deep*, they will enter the anterior chamber and damage the endothelium on the back of the cornea. You will need a steady hand, so support your wrist on the patient's forehead, or on a sandbag underneath the drapes beside the head, or support your wrist on your assistant's fist.

Hold the edge of the wound (not the whole thickness of the cornea) obliquely with fine toothed forceps, so that one blade enters the wound (52-6G). While you are holding the edge of the wound undistorted with forceps, insert the needle at almost 90° into the cornea 1.5mm from the wound edge. As the needle goes through it, let the needle holder follow its curve. Aim the needle to enter the wound in the posterior one third of the cornea. It should then pass across the wound to the matching opposite edge, and come out at 90° to the cornea. If the wound is vertical, bring the suture out 0.5mm from its edge. If it is oblique, bring it out 1mm from the wound edge.

Pull the suture material through the wound, until only about 1cm remains. Tie the suture in three throws by winding the monofilament round the needle holder or the suture tying forceps. Use 3 turns for the first throw, then one, and then another one, (52-6M,N).

CAUTION! Don't pass sutures through the iris. If this happens, remove it.

Use the first throw to bring the tissues together without any tension. Leave a tiny loop between the 1st & 2nd throws to make sure that no undesirable tension is transmitted to the 1st throw. Pull the 3rd throw down and hold it down so that it can mould into a knot. Pull one side of the suture, as it emerges from the cornea so that the knot just enters the needle track. This will make the patient more comfortable while the eye heals. Instil cycloplegic such as cyclopentolate or atropine drops.

CAUTION! Don't try to reconstitute the anterior chamber by injecting air or saline. This is a highly skilled task, and you are likely to do more harm than good.

SCLERAL LACERATIONS

Suture the sclera in the same way as the cornea, but use 5/0 sutures of atraumatic monofilament. Cover the sutures in the sclera by repairing the conjunctiva over them with fine silk (6/0-8/0, 52-52). Leave the scleral sutures in place, but remove those in the conjunctiva.

If vitreous prolapses through a scleral wound, excise it. Dip a swab into the wound and lift the vitreous away. If a strand of vitreous is pulled from the wound, cut it off with scissors. The proximal end of the strand will retract into the eye. Repeat this until you have removed all the vitreous that has escaped from the globe. If some still oozes out or sits on the wound, aspirate it using a wide bore needle. Then suture the sclera as above.

CAUTION! Don't allow vitreous to remain trapped at the wound edges, because healing will be poor.

POST-OP CARE FOR CORNEAL & SCLERAL WOUNDS
Instil cyclopentolate, antibiotic, pad and bandage the eye. Leave the sutures in for 2 months if the eye is comfortable and quiet. To remove them, lie the patient flat, infiltrate with retro- or peri-bulbar LA and insert a speculum. Use the bevel of a 25G needle as a blade to slide under the suture and cut it. Pull it out with a suture forceps.

52.6 Iris injury

The iris can be torn, detached from the ciliary body, or it can herniate through a wound in the cornea & sclera. There are usually a hyphaema and other eye injuries present. Sometimes, the lens is also dislocated & the vitreous is herniating into the anterior chamber. If the iris or ciliary body remain prolapsed, the risk of infection and sympathetic ophthalmitis (52.10) is greatly increased.

IRIS INJURIES
If the iris has prolapsed through a corneal wound (52-6J) <24h before, and it is clean, put it back in the eye with an iris spatula. Try to separate the iris from the rest of the wound, to prevent the formation of anterior synechiae (adhesions). This is difficult. Excision is simple, and may be wiser.

If the iris is obviously damaged or contaminated, excise it. Grasp it with fine toothed iris forceps, draw it a little further out of the wound, and cut it with spring scissors flush with the cornea. Stroke the wound, so that the cut edges of the iris retract back. Or, gently push them back with an iris spatula. Provided there is no blood in the anterior chamber, instill sterile atropine 1% bd.

If the cut edge of the iris bleeds, put a drop of 1/1000 adrenaline into the conjunctiva. It will control bleeding and dilate the pupil.

POSTOPERATIVELY, shield the eye for 3days, or until pain stops. If light disturbs, pad both the eyes.

52.7 Penetrating injury of the globe

The anterior part of the globe is most at risk. The lens may be injured, and there may be a foreign body in the globe (52.9). Delay after 24h worsens the prognosis for sight. You may see the injury, and if it is in the cornea, it may be plugged by iris. It may be small, so look carefully. All you may see is a tiny hole in the iris and a lens opacity. Provided you are sure that there is no foreign body, suture any lacerations (52.4)

52.8 Blunt injury of the globe

A blow to the eye may:
(1) rupture the globe parallel to and just behind the limbus, causing black uveal tissue to prolapse (52-7B). The conjunctiva over it may or may not be torn.
(2) rupture the globe near the optic nerve. You may see this injury with an ophthalmoscope, but no repair is possible.
(3) detach the retina without tearing the choroid. The detached part is grey, instead of its normal red colour, and the vessels over it are dark, almost black.
(4) lacerate the choroid & retina without rupturing the sclera.

Again, the common sites are near the optic disc, and peripherally near the limbus, where the retina is inserted into the ciliary body. You can only see the central ⅓ of the fundus with an ophthalmoscope, so you will see tears near the optic disc, but not peripherally.

At the start, blood in the vitreous may obscure a central tear, but when this has cleared you will see it as a semicircular slit in the retina exposing the white of the sclera (52-7A).

Keep the patient in bed until the blood has cleared. A retinal tear never heals and is almost always followed by retinal detachment from the choroid, perhaps years later. No repair is possible without sophisticated equipment.

N.B. Blunt eye injury can also occur from sudden deceleration, e.g. in diving, sky-falling, & bunjee jumping. If the injury is unilateral, it may not be noticed for some considerable time.

BLUNT EYE INJURIES

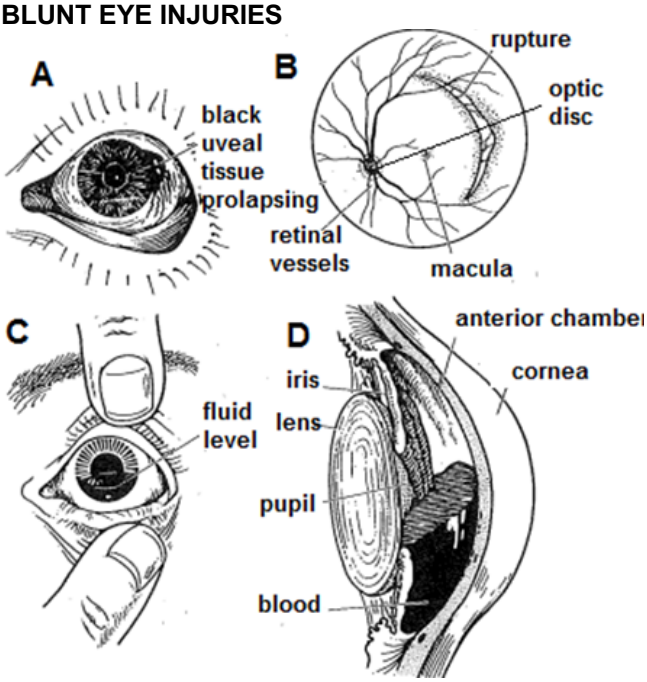

Fig. 52-7 VARIOUS BLUNT EYE INJURIES. A, the globe has ruptured just behind the limbus. The iris & ciliary body have prolapsed through the tear and lie under the conjunctiva. B, choroid rupture exposing the white of the sclera (often by a blow from a fist). C,D, hyphaema with an obvious fluid level.

MANAGEMENT

If the eye is so hopelessly injured that any useful sight is impossible, enucleate it (28.14), but wait a while before you do this.

If the globe is less severely injured, expose the scleral wound by making an opening through the conjunctiva parallel to it. Divide Tenon's capsule, and clean its lips. Gently replace any undamaged prolapsed uveal tissue with a blunt spatula.

Excise any damaged tissue and remove any prolapsed vitreous. Close the sclera with interrupted sutures (52.4), then suture the conjunctiva.

CAUTION! Don't try injecting air into the eye to restore its intraocular pressure.

Administer a course of subconjunctival antibiotics (28.1).

If you suspect a retinal injury, refer to an eye centre with the eye properly padded as soon as you can. Provided the macula is not involved, the retina can be repaired.

If a lens opacity develops after a blunt injury or electrocution, this is a traumatic cataract (28-10).

52.9 Bleeding into an injured eye

Bleeding from the iris into the anterior chamber (hyphaema) is common, and can occur immediately after injury, or later after some hrs or days. If the blood fills <⅓, the hyphaema is mild but indicates an iris tear (which may be obscured by blood); this may be partial or complete. The patient will complain of poor vision.

On examination, there may be:
(1) a diffuse reddish haze in the anterior chamber (mild bleeding).
(2) a settled layer of blood (52-7C)
(3) the anterior chamber entirely full of blood or clot, obscuring everything; the eye may feel abnormally hard.

Fortunately, bleeding into the anterior chamber usually stops spontaneously, but in 20% of cases it starts again during the following week. If it does start again, it is likely to be more severe than after the original injury. So, to prevent this, test for sickle cell disease & blood clotting disorders. Keep the patient on bed rest with the head elevated at 30° for 1wk, use cycloplegic & antibiotic drops & put a pad over both eyes. Avoid aspirin & NSAIDs which may promote bleeding.

If the hyphaema does not resolve after 4wks, insert a very fine butterfly needle into the anterior chamber at a tangent & wash it out with sterile saline. If there is clotted blood, make a small incision in the lateral limbus, extract the clot with fine forceps, and close the wound.

Follow up the patient for glaucoma.

52.10 Ocular foreign bodies

Foreign bodies are often missed, because nobody looks for them. They can be embedded in the cornea, or lodged in the upper conjunctival fornix, and are then only seen when the eye is everted and examined using a slit lamp.

Always instil some LA drops into the eye before you try to remove any foreign body. The risk is infection. Fortunately, most foreign bodies do not penetrate deeper than the conjunctiva or sclera.

The commonest penetrating object is a piece of steel which breaks off a cold chisel on hammering. When this happens, there may be a stained area in the cornea, a tiny hole in the iris, and signs of an early cataract. This may have been misdiagnosed as conjunctivitis.

The history, and the fact that the eye remains red and watery should however make you suspicious. If a patient has a painful eye and has been doing anything which might have caused a foreign body to enter it, assume that there is one until you have proved otherwise.

OCULAR FOREIGN BODIES

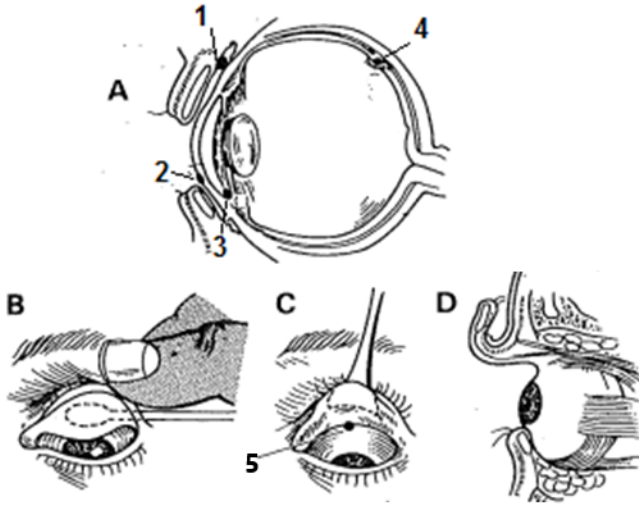

Fig. 52-8 FOREIGN BODIES. A, common sites for foreign bodies: (1) the conjunctival fornix, (2) the cornea (foreign bodies here usually lie within the fissure formed by the lids), (3) the anterior chamber, (4) the retina. B, single eversion of the lid. C, D, double eversion (5) the conjunctiva. *After Peyman GA, Principles & Practice of Ophthalmology, WB Saunders, London 1980 with kind permission.*

Look for an entry wound in: (1) the lids, (2) the sclera, or (3) the cornea. Stain the cornea. Feel the tension in the globe. Examine the anterior chamber for a hyphaema, and the iris for a tear. Look for the foreign body with an ophthalmoscope.

CAUTION! The entry wound in the cornea may be a very small one indeed. Look for a tiny haemorrhage.

CONJUNCTIVAL FOREIGN BODIES

If a patient complains that something has got into the eye, you will probably find it in the upper or lower conjunctival fornix, usually the upper one. Search both, and evert the upper lid (52-8B). You will probably find the foreign body c.3mm from the lid margin. Brush the foreign body away with a cotton wool swab on a matchstick. *Don't be content with only finding one foreign body*; expect to find several more.

If there is a foreign body but you cannot see it, *be sure to instil fluorescein*. You may see an abrasion, a laceration, or the foreign body itself.

If the foreign body is embedded in the conjunctiva, instil a few drops of LA, pick it up with forceps and snip it out with the overlying conjunctiva, if necessary.

If fragments of spectacle glass have entered the eye, remove them with forceps, and sweep them out of the fornices with a cotton wool swab on a match stick.

CAUTION! Always examine the cornea carefully, and stain it with fluorescein, even if you find a foreign body in the conjunctiva.

CORNEAL FOREIGN BODIES

The eye is painful, red, tearful, and photophobic. You will need great care, a steady hand, LA eyedrops, good magnification, and a strong light and preferably a slit lamp.

Stain the cornea with fluorescein, hold the eye open, and examine the cornea.

If you can see a corneal foreign body, wipe it away with a swab or moist cotton tipped applicator.

If the foreign body is firmly attached to the cornea, put the tip of a sterile disposable hypodermic needle under it, and lift it out of its small pit in the cornea.

CAUTION! (1) *Don't damage the surrounding normal cornea.* (2) The cornea is thin (1mm) and tough, so *don't push the foreign body through it into the anterior chamber*. (3) Use a fine sharp needle, not a corneal spud.

If fluorescein shows vertical corneal stains, a foreign body has stuck to the deep surface of the upper lid, and is scratching the cornea. Evert the upper lid, and remove the foreign body by rubbing it with a swab.

If an iron containing foreign body has remained in the cornea for any length of time, a ring of rust forms. You must remove the foreign body, but if you cannot easily lift out the rust ring, leave it.

CAUTION! Whenever there is or has been a foreign body in the eye, instil antibiotic drops, and pad it.

POSTOPERATIVE CARE

On the following day, stain the cornea with fluorescein.

If there is any area of staining and the eye looks irritated, dilate the pupil with a short acting drops such as tropicamide and bandage the eye.

A PENETRATING EYE INJURY

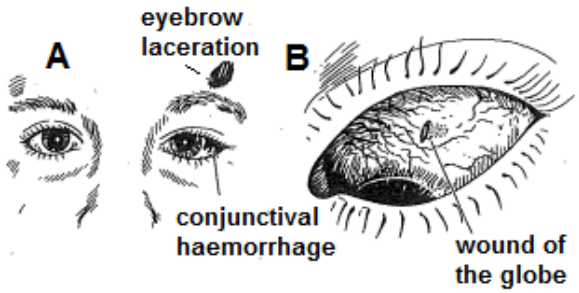

Fig. 52-9 A PENETRATING INJURY OF THE GLOBE. This patient has a penetrating injury well above the eye. A, conjunctival bleeding should make you suspicious. B, only when the patient looks down and inwards, will you see the injury of the globe. *After Goldberg S, Ophthalmology made ridiculously simple, Medmaster, Miami, FL, 1982*

INTRAOCULAR FOREIGN BODIES

Take lateral double exposure radiographs of the orbit with the eye looking up and down. If the foreign body changes its position in these two views, it is probably inside the eye.

If it is a metallic foreign body, refer for its removal.

If it is a small splinter of sand or glass, you may leave it.

N.B. Leave any orbital foreign bodies.

52.11 Endophthalmitis after injury

This takes two forms, the 1st very common and the 2nd very rare.

(1) Bacteria may invade the eye through even a minor injury, which is one of the reasons why these injuries should be treated so carefully.

(2) An immune reaction (sympathetic ophthalmitis) can involve the normal eye 4-8wks after the original injury.

When this happens, it becomes sensitive to light, red (with ciliary injection), and painful; its near vision is transiently blurred. *Don't remove the injured eye*; it may in the end have better vision than the other one. Use steroids.

BACTERIAL ENDOPTHALMITIS

If the cornea is cloudy, there is an abscess in it, or there is pus in the anterior chamber, start a course of subconjunctival chloramphenicol or gentamicin (28.1). If possible, culture the conjunctiva. Instil drops of atropine 1% into the conjunctiva.

52.12 Orbital fracture

Direct blunt force against the globe may result in a 'blow-out' fracture where the fine bones of the orbital floor are broken. This typically happens with a punch, or a squash ball hit straight at the orbit. If the orbital contents fall into the maxillary sinus underneath, the eye will look sunken (enophthalmos), and upward movement will be impaired, causing diplopia.

ORBITAL FLOOR BLOW-OUT FRACTURE

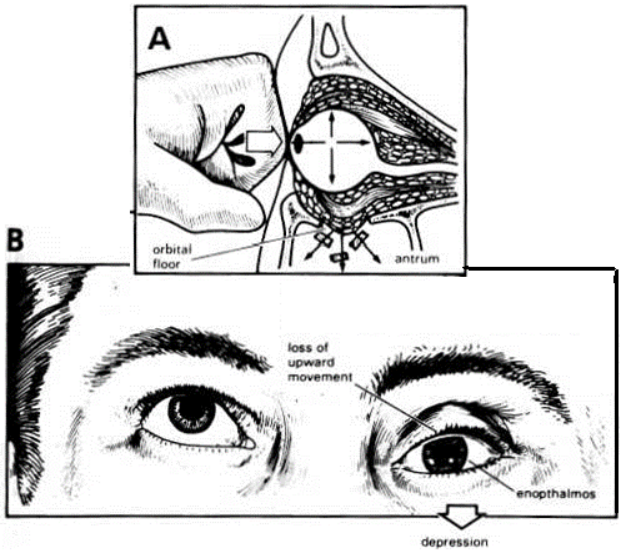

Fig. 52-10 ORBITAL BLOW-OUT FRACTURE. A, B, a blow to the orbit has broken its floor, so that its contents have prolapsed into the maxillary sinus. *From Accident & Emergency Medicine, Rutherford, Nelson, Weston & Wilson eds. Pitman 1980 with kind permission.*

REDUCTION OF A BLOW-OUT ORBITAL FRACTURE (GRADE 2.4)

Under LA, or better, ketamine, make an opening into the maxillary sinus (29.8) and insert a Ch12 Foley catheter. Inflate the balloon with water very slowly while watching the eyes from above the patient's head. Stop when their protrusions are symmetrical. *Don't exert excess pressure* as this may compress the eyeball. Check the vision regularly post-op.

N.B. You can also pack the maxillary sinus, but this is more difficult & less easy to monitor.

Significant missile injuries to the orbit may involve the frontal sinus, and brain. The eye is often totally disrupted. Packing & damp dressing the wound is all that you can do in the first instance.

52.13 Eye injury in children

All the described injuries may occur in children, but certain specific trauma should give rise to the suspicion of non-accidental trauma (47.2):

(a) Periorbital bruising
(b) Hyphaema
(c) Traumatic mydriasis
(d) Lens subluxation
(e) Retinal detachment
(f) Retinal, subhyaloid or vitreous haemorrhage

Such trauma may later lead to optic atrophy and squint.