INJURIES OF THE EYE*

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This is too large a subject to go into much detail, or even cover completely without detail, in one lecture, but a general plan for the examination and treatment of these injuries can be given, and fuller details found in the textbooks.

Injuries of the eye are usually divided into:—

1. *Penetrating.*
 - (a) Without retained foreign body.
 - (b) With retained foreign body.
2. *Non-Penetrating.*
3. *Ruptured Globe.*
 - (a) Subconjunctival.
 - (b) With rupture of conjunctiva.

Taking first the penetrating injuries, these may of course be slight or serious, depending on (a) the degree of damage to the underlying tissues, and (b) the presence of primary or secondary infection. For instance, the cornea may just be penetrated by a thorn or a spicule of glass, which, when withdrawn, allows the wound to close with no appreciable loss of aqueous and, consequently no prolapse of iris. Such cases need no special treatment save that of a superficial lesion, while the epithelium regenerates. The wound may be larger, and more aqueous lost, causing the iris to prolapse and plug the gap; the lens may be injured, giving rise to a traumatic cataract; or the vitreous may be penetrated, with additional risk of immediate or subsequent loss of sight.

In all cases the object of treatment is:—

1. To see that the edges of the wound can come into apposition, by removing any prolapsed tissue, and making sure that both pillars of the cut iris (after iridectomy) are freed from the posterior margin of the wound, so that any track, along which secondary infection may pass, is closed as quickly as possible;
2. To prevent the risk of secondary infection, as far as possible, by irrigation and, nowadays, the instillation of sulphacetamide and penicillin drops;
3. To watch for any signs of primary infection of the globe, due to organisms carried into the eye at the time of injury.

As regards iridectomy, it is always easy to completely free one pillar of the cut iris, but the second pillar may cause difficulty. In most cases the cut slopes through the corneal substance, so that one posterior margin of the cut forms a spur, and round this it is difficult, if not impossible, to manipulate an iris repositor and get it between the posterior corneal surface and the iris. So it is

usually a wise precaution to make a small keratome incision at the limbus well away from the wound, as the first step in the operation, before withdrawal of the iris, and while an anterior chamber is still present. One can then free the difficult pillar, if it is necessary, however adherent it may be to the cornea, by passing a repositor across the anterior chamber through the keratome incision, at the end of the operation.

If the wound is large, and the margins do not readily come into apposition, it should be covered with a conjunctival flap, to assist its closure and the re-formation of an anterior chamber.

If the lens has been injured and there is already soft cortex in the anterior chamber, this should be washed out with normal saline.

Corneal wounds involving the vitreous as well as the lens most frequently necessitate removal of the eye later, and, if there is faulty projection to light, indicating gross retinal injury, the globe should be excised forthwith. Otherwise it can be watched for a few days to see whether inflammation subsides and vision improves.

Either primary or secondary infections may be acute (e.g. from pneumococcus, streptococcus or staphylococcus aureus) or subacute. The infection may be purely anterior, and evidenced by onset of iritis and hypopyon. In this case it may be controllable by ordinary methods, combined with sulphonamide and penicillin therapy. If the lens has been injured and there is cortex in the anterior chamber, chances of control are less hopeful, and if the infection has been carried into the vitreous (or has tracked there in secondary infection) there is little expectation of recovery, and, in most cases, the eye has to be excised or eviscerated.

Such cases, with acute infection, do not later on give rise to anxiety about the onset of sympathetic inflammation in the fellow eye. It is the low-grade infections, which give rise to a subacute iridocyclitis or uveitis, which have to be carefully watched on this account. As a general rule one need not worry about the onset of sympathetic inflammation for two weeks, except in children, in whom one has only a margin of safety of some eight to ten days. I have seen one very definite case of sympathetic ophthalmia in a child of three years, which commenced on the ninth day after injury of the other eye.

All such cases should be under expert care, as the decision whether or no an injured eye can be safely kept, without danger to its fellow, is often a difficult matter, and much depends on experience. As a rough rule for anyone who is practising far from specialist help it may be said that any injured

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eye in which inflammation is not steadily subsiding after two weeks should be removed. But in these days of quick transport by aeroplane ambulance it should usually be possible to get any such case to hospital, and the sooner after the injury the better.

The main principles given above apply to scleral, as well as to corneal wounds, but in these primary or secondary infection of the vitreous is more probable, and serious damage to the retina more likely. It is harder to clear the wound of prolapsed uvea and vitreous than it is to clear a corneal wound of prolapsed iris. If scleral sutures are to be inserted, this should be done before the prolapsed uvea and vitreous are cut away and left ready to tie immediately afterwards, but, in my experience it is usually equally (or even more) efficacious to cover the wound with a good conjunctival flap, and I should not recommend any relative novice, in case of emergency, to try suturing the sclera. He will do more harm to the underlying tissues than he is likely to do good from better apposition of the wound.

Next in order come the penetrating injuries with retained foreign body.

These cases are, of course, always serious and only those in which the injury to the globe is so gross that the eye requires immediate excision can be dealt with by any but the true expert who has complete equipment available.

Diagnosis may be easy, but in the case of smaller particles, and especially those entering through the sclera, it may be difficult. Any case in which there is the slightest possibility of a foreign body having penetrated the eye should be sent to an ophthalmic surgeon.

Where the entry is through the cornea one looks for the corneal scar, which may be small and easily missed, and for signs of a track through iris and lens into the vitreous. Such signs are illustrated in the accompanying drawing, Fig. 1, which shows a small perforation in the iris, with localised opacity in the lens beneath, and, on examination of the interior of the eye with an ophthalmoscope, a track through the vitreous leading to an area of injury (in this case older and with scar tissue forming) on the lower part of the optic disc, Fig 2. Sometimes one can see the actual foreign body lying on the retina, or suspended in the vitreous and, in cases of scleral entry, in which the lens is likely to remain clear, the fundus examination is the most important diagnostic and localising procedure.

Where the lens is already opaque in corneal penetrations, the vitreous is too full of haemorrhage or the particle too anterior, for a positive diagnosis to be made, one has to prove the presence or absence of a foreign body by X-ray examination. Details of this, with accurate methods of localisa-

tion must be studied in books of reference and recent articles in the *B.J.O.* Accurate localisation is the more important when removal of the foreign body by the scleral route is planned.

Except in rare instances inert foreign bodies, such as fragments of glass or stone, are best left alone, but the eye has to be carefully watched for many months to see that no signs of cyclitis or uveitis arise. If they do excision of the eye is indicated on account of the risk of sympathetic ophthalmia.

Chemically active metallic foreign bodies have to be removed, as they set up irritation of the uvea and a chronic inflammation which may well lead to a definite sympathetic inflammation of the fellow eye if they are allowed to remain. Fragments of iron or steel, if not removed, set up a condition known as "siderosis bulbi," with rust deposits in the tissues of the eye and degeneration of the retina with failing vision. Fortunately most of these can be removed by means of a giant magnet. Formerly steel was strongly magnetic, but, nowadays, there are many forms of steel alloys used in the manufacture of instruments and weapons which have very feeble magnetic properties. Consequently, whereas one almost always used to employ the "anterior route" (i.e. bringing the magnetic particle forwards into the anterior chamber by applying the pole of the magnet almost to the cornea, and then removing with the hand magnet after a keratome incision at the limbus above), nowadays one has to bring the pole of the magnet much closer to the particle, in order to move and extract it. This is the reason for the more frequent employment of the scleral method of approach on which there has been a good deal of literature during the past few years.

The presence of other chemically active bodies, such as fragments of copper or brass, usually entails excision of the eye, but occasionally they can be removed, if in the vitreous, by accurate localisation with the ophthalmoscope and X-rays, incision of the sclera at the right spot, and the insertion of fine forceps; such manipulation is most likely to succeed if directed by ophthalmoscopic observation by a second observer. The area of sclera involved is first ringed by a series of points of diathermic reaction, in the expectation of preventing subsequent detachment of the retina.

Foreign bodies embedded in the lens, as seen by oblique illumination or by the ophthalmoscope, or localised by X-rays, can be left until such time as the traumatic cataract can best be dealt with.

Non-magnetic particles in the anterior chamber can often be picked out with very fine forceps after making a keratome incision in the cornea on the opposite side of the eye from which they

are lying, the point of the keratome being directed at the foreign body.

Primary or secondary infection along the track, of course, requires the same treatment and watchful care as mentioned earlier on.

Non-penetrating injuries of the eye give rise to less anxiety on the part of the surgeon, though their effect on vision may be serious to the patient. Every structure in the eye may be affected if the force applied is sufficient, and one can tabulate them systematically from the cornea to the retina. Time does not allow of much detail.

Cornea.—Superficial abrasions. Embedded foreign bodies. Cuts of corneal substance.

Iris.—Tears at periphery (iridodialysis). Tears at pupil margin. Contusion of the sphincter muscle giving rise to a dilated pupil. When the lens underlying the iris is dislocated or subluxated the iris is seen to be tremulous (iridodonesis).

Lens.—When the blow has been severe an imprint of the pupil margin may be left on the anterior capsule (Vossius ring). Traumatic cataract, normally in posterior cortex, round to which lines of force converge, causing separation of fibres and coagulation of lens protein; such cataract is usually "star shaped." Partial dislocation of lens (subluxation). Complete posterior dislocation of the lens.

Ciliary body.—Contusion with weakness of accommodation, which in a few cases persists.

Vitreous.—Haemorrhage and oedema, which may cause increased tension, are secondary to injuries of other parts.

Retina.—"Commotio Retinae" or oedema, is the most frequent change, with which may be associated a so-called "hole at the macula," due to the retina being thinner at and around the fovea, and transparent relatively to the thicker oedematous membrane. After two or three weeks retinal pigment may migrate to the surface in the central area, as an indication of serious and permanent injury with varying degrees of visual impairment. This change may go on for about six weeks.

Retinal haemorrhages of all kinds. If the hyaloid membrane has been ruptured some haemorrhage may come forward into the vitreous. Fibrous bands may later form as the haemorrhages organise. Tears in the retina, peripheral (dialysis when the retina is torn from the ciliary region) or elsewhere. These frequently give rise to immediate or subsequent detachment of the retina, which usually responds well to operation by diathermy.

Choroid.—This may be split (ruptured choroid) in one or more places, usually concentric with the optic disc at a little distance from it.

While the tension is usually lowered after a blow on the eye, owing to a partial dialysis of the ciliary body and a freer entry for fluid into the supra-choroidal space, it may be increased, owing to swelling of the vitreous due to haemorrhage or oedema. In the former cases atropine is used for a few days, to keep the eye at rest, but should be discontinued after a week to let the iris and ciliary muscle recover their tone, and favour further absorption of blood clot. It is often continued too long. When the tension is raised it is wise not to use atropine at first, but eserine is not indicated for the first twenty-four hours. An injection of morphia, instillation of adrenalin drops and complete rest in bed will frequently allow the oedema to subside and the tension to become lower.

Finally, a word about ruptured globe. If this is subconjunctival it is wisest to hold one's hand and not operate. I have seen two cases of ruptured sclera with subconjunctival dislocation of the lens, in which the temptation to operate was resisted, and both eyes recovered with some reasonably good vision with a cataract lens; another with a small subconjunctival prolapse of the iris up and out, had the lens dislocated into the vitreous, and, two years later, had vision of 6/9 with correction. Some of my younger colleagues would not have been so conservative with these cases.

The cases with ruptured conjunctiva have to be treated like those of scleral perforating wounds.