CHAPTER 14 INJURIES TO THE EYE, EYELIDS AND ORBIT

General Principles

The eye and its adnexae are highly specialised tissues which respond unfavourably to trauma. Even mild scarring may adversely affect the optical properties of the eye with dire consequences for vision. It is axiomatic that in repair of eye injuries medial clarity should be preserved and intraocular organisation kept to a minimum. Most eye injuries require the attention of an ophthalmic surgeon with access to specialised equipment and where multiple injuries are present the eye should be protected with a resilient periorbital shield until appropriate treatment can be instituted.

The evaluation of ocular and adnexal injuries should include a detailed history of the event with particular reference to foreign bodies, evaluation of visual functions and examination of the eyes, both anterior and posterior segments, under magnification. This chapter covers in more detail some topics already outlined in Chapter 2. There is also some new material on orbital trauma.

A. EYELID LACERATIONS

1. Superficial lacerations

Most superficial lacerations can be satisfactorily sutured under local anaesthetic using either 6/0 silk or 6/0 prolene.

2. Deep - full thickness eyelid lacerations

Deep lacerations may involve the full thickness of the eyelid and the orbital septum with prolapse of orbital fat. The underlying globe may also be perforated in which instance there will be loss of vision with hypotonia of the globe. During major repairs of upper or lower eyelids the eye itself must be protected, usually with a plastic shell. Imperfectly repaired eyelid lacerations cause long-term ocular discomfort and occasionally ocular scarring with loss of vision. Ideally, all eyelid lacerations should be sutured by an ophthalmic surgeon and it is better to delay surgical repair of an eyelid rather than execute imperfect apposition or repair of tissues. Perforation of the orbital septum should be closed with 6/0 catgut after repositioning the orbital fat. Tarsal plate lacerations and orbicularis muscle defects should be carefully aligned and sutured with 5/0 catgut. The skin should be closed with 6/0 silk or nylon. Lacerations involving the tendinous expansion of levator palpebrae superioris may cause ptosis and if large should be carefully exposed and meticulously sutured with 5/0 catgut.

3. Lacerations involving the eyelid margins

Marginal lacerations must be meticulously apposed to prevent lid notching, trichiasis and keratotic plaque formation, which cause irritation and scarring of the cornea. Lid wounds should be carefully cleaned and trimmed and the sharp apposing edges then precisely closed in three layers. The lid margin should be aligned using two 6/0 silk sutures, one placed at the level of the gray line and the other just posterior to the last line.

The tarsal plate edges and orbicularis muscle should be accurately apposed and sutured with 6/0 plain catgut. The skin should be closed with 6/0 silk or Prolene.

Injuries at the medial canthus may involve the upper or lower lacrimal canaliculus and care should be take to appose the cut ends of this structure. The patient should be warned that watering of the eye may persist even after careful repair, especially if the lower canaliculus is involved, as 60% of the tears are drained through the lower canaliculus.

4. Eyelid laceration with tissue loss - eyelid avulsion.

Prior to repair, the anterior segment of the eye must be protected with moist saline swabs or a scleral 'bandage' contact lens. Immediate surgery and repair is directed towards achieving adequate protection of the eye and re-establishing normal structure and function of the eyelid. Careful repair of the various eyelid components is undertaken under a dry field and defects are closed by mobilising, transferring or transplanting eyelid or facial tissue. Extensive reconstructive surgery may be required at a later date.

B. CHEMICAL BURNS

1. Superficial

Superficial eyelid burns are caused by electric arc flashes, ultraviolet light and industrial detergents. Most heal quickly and require only careful cleaning and removal of residual chemical particles or foreign bodies. The cornea and conjunctiva may be involved and antibiotic and cycloplegia drops should be instilled to control the underlying keratitis and conjunctivitis.

2. Deep

Deep burns are usually a consequence of splashing the eyelids with acid or alkali, or occur as part of a generalised facial burn. If severe necrosis is present, early grafting may be required to prevent scarring, contracture and loss of eyelid function.

C. INJURIES TO THE CONJUNCTIVA

1. Contusion, Haemorrhage, Chemosis

Subconjunctival haemorrhages resolve within two to three weeks and require no treatment. Occasionally a dense subconjunctival haemorrhage may camouflage an underlying scleral rupture or indicate a fracture at the base of the skull or orbital bones. Loss of vision, vitreous haemorrhage and abnormally low intraocular pressure indicate the presence of a scleral tear or rupture. The patient should be immediately prepared for exploration of the globe under general anaesthesia.

2. Lacerations

All conjunctival lacerations should be explored to exclude an underlying perforating scleral wound. Small uncomplicated conjunctival lacerations may be left unsutured if the wound margins are approximated and no Tenon's capsule is protruding. Extensive conjunctival lacerations should be sutured using 6/0 plain catgut. Any associated scleral or extraocular muscle laceration should be careful sutured using an operating microscope.

3. Foreign bodies

Conjunctival foreign bodies are common and characteristically lodge in the subtarsal sulcus of the upper eyelid. Small foreign bodies can be removed using a cotton-tipped applicator after a thorough search of the fornices and after everting the upper eyelid. Multiple loose foreign bodies or particular chemical matter can be removed by irrigating the conjunctival sac with normal saline. Foreign bodies that have become embedded in the interpalpebral conjunctiva following blast injuries should be teased free with a needle or fine forceps, otherwise unsightly tattoo marks will persist.

4. Burns

Chemical burns of the conjunctiva are ocular emergencies and usually involve the anterior segment of the eye. Alkalis rapidly penetrate the cornea and cause a severe inflammatory reaction in the anterior chamber and irreversible damage to the anterior uvea. Immediate and meticulous irrigation of the conjunctival sac is required with removal of all particulate chemical material. Chelating agents and vitamin c eye drops may be useful in lime burns and antibiotic drops should be prescribed to prevent secondary infection. Local or systemic steroids may be required to preserve the integrity of the conjunctiva and cornea and suppress intraocular inflammation. Conjunctival adhesions may develop and should be relieved using a glass rod lubricated with antibiotic ointment. Maintenance of the fornices may require insertion of a scleral contact lens for a period of time.

D. INJURIES TO THE GLOBE

1. Corneal Abrasion

The extent of the abrasion may be determined using a fluorescein drop. After instillation of a local anaesthetic drop (Amethocaine 1%) into the conjunctival sac, all foreign bodies should be removed and a short acting mydriatic and cycloplegic instilled to relieve spasm of the ciliary muscle. Antibiotic ointment is applied, followed by a firm pad and bandage to prevent excessive movement over the lesion. A patient with an extensive abrasion should be referred to an ophthalmic outpatient clinic to document and confirm healing of the abrasion. Local anaesthetic drops should be used for diagnostic purposes only and have no part in any therapeutic regimen as they can be toxic to the corneal epithelium.

2. Corneal foreign body

Superficial corneal foreign bodies can be removed using a moistened cotton-tipped applicator. Embedded foreign bodies may be removed with a sharp pointed instrument or needle under direct vision aided by slit lamp biomicroscopy. Rust rings, which contain ferrous particles and irritate the cornea, should be meticulously removed using a sharp needle or a battery-driven burr specially designed for this purpose. Foreign bodies involving the axial cornea should be removed with particular care to avoid scarring in this critical area. Antibiotic drops and cycloplegics should be instilled and a firm pad and bandage applied for 24 hours. Foreign bodies lodged deeply within the cornea require to be carefully removed under magnification, occasionally with the assistance of a magnet under an operating microscope. Some foreign bodies projecting into the anterior chamber of the eye necessitate removal by an intraocular route under general anaesthesia.

3. Corneo-scleral lacerations

a) Non-perforating

Non-perforating corneal or scleral lacerations require no surgical treatment if they are superficial and the wound edge is well apposed. A firm pad and bandage usually provides sufficient external splintage for most corneal wounds. Deep corneal or scleral lacerations require careful suturing under an operating microscope using 8/0 Virgin silk for scleral lacerations and 10/0 monofilament nylon for corneal lacerations.

b) Perforating lacerations

Perforating injuries of the eye are ophthalmic emergencies and should be dealt with immediately by an experienced ophthalmologist. Wounds should be repaired accurately so as to restore normal shape and refractive properties to the globe. Perforating injuries of the eye take priority over lacerations of the eyelid and face and should be treated before any manipulation of facial fractures as external pressure may precipitate loss of intraocular contents and irreparable damage to vision. Perforating corneal or scleral wounds may be associated with a retained intraocular foreign body and all such patients should have x-ray evaluation and localisation of foreign bodies. Prolapsed and incarcerated uveal tissue, lens remnants or vitreous should be meticulously removed from the wound and infection controlled with local and systemic antibiotics. Intraocular organisation should be kept to a minimum by the judicious use of local and systemic corticosteroids. Posterior scleral perforations typically involve the retina and require special procedures to prevent subsequent retinal detachment, i.e. cryotherapy and techniques to reduce the volume of the posterior globe. Where a severe perforating injury has resulted in intraocular disorganisation, inflammation and loss of vision, enucleation may be advisable in view of continuing discomfort and the risk of sympathetic ophthalmia. Between 15% and 20% of eyes with perforating wounds are eventually enucleated.

If a serviceable eye is retained, long-term treatment will be directed towards the preservation of clarity of the axial media and regaining the normal refractive properties of the eye. Additional procedures may be needed to prevent retinal detachment and secondary glaucoma.

4. Intraocular foreign bodies

Most intraocular foreign bodies are metallic or glass and result from metal or stone being struck with a hammer or are sustained during the shattering of a windscreen in a road traffic accident. An intraocular foreign body should be suspected if there is a history of 'hammer and chisel injury', evidence of a small perforating corneal or scleral laceration, a localised iris tear, lens opacity or intraocular haemorrhage. With rare exceptions all intraocular foreign bodies should be removed as they cause severe damage secondary to siderosis, infection or uveitis. Intraocular foreign bodies can be conveniently extracted using a hand or giant magnet; non-magnetic foreign bodies must be removed by direct means, e.g. using intraocular forceps or by vitrectomy. These techniques are difficult, require hospitalisation and may be complicated by cataract, retinal detachment, glaucoma and endophthalmitis.

5. Ocular Contusions

Blunt injuries to the eyes are common and have particularly serious consequences for vision. They may cause intraocular haemorrhage, cataract, secondary glaucoma, retinal detachment and serious damage to the optic nerve.

Patients with significant hyphaemas (blood in the anterior chamber of the eye) require hospital admission and observation. Secondary haemorrhage which occasionally occurs, typically within 2 to 5 days, is often associated with glaucoma and may require active therapy. Following resolution of intraocular haemorrhage, full ocular examination is required to exclude glaucoma, cataract and peripheral retinal detachment. A vitreous haemorrhage following contusional injury to the eye should alert the physician to the likely presence of an occult posterior scleral rupture or retinal tear or detachment. Admission, bedrest and observation is required. An ultrasound scan may be useful in diagnosis. Scleral ruptures, if present, should be repaired and any retinal dehiscence should be identified and sealed. A retinal detachment will require immediate therapy and long term follow up.

E. INJURIES TO THE ORBIT

1. Perforating injuries

Perforating injuries of the orbit are uncommon but may be associated with damage to the eye and brain. If a projectile or perforating object has breached the bony orbit, neurological evaluation and radiology of the skull and orbit should be undertaken. Combined exploration of the orbit and cranial cavity may be required. If the bony orbit is intact and the eye uninjured, the wound should be explored, foreign bodies removed and necrotic tissue excised. Defects in the orbital fascia should be closed with 5/0 or 6/0 plain catgut and any extraocular muscle damage repaired. Foreign bodies, with the exception of deeply embedded glass or plastic particles, should be removed.

2. Fracture of the orbital margins

Most fractures of the orbital margins have no serious visual consequences unless the eye is damaged. Most fractures of the orbital wall, despite involving the paranasal sinuses, heal satisfactorily and without complication and merely require systemic antibiotic therapy to prevent secondary infection. Fractures of the orbital margin not associated with ocular disturbance or change in the patient's binocular status require repair only if cosmetically unacceptable.

3. Blow-out fractures of the orbit

Direct blows to the orbit may cause outward displacement of part of one of the bony walls of the orbit, usually leaving the anterior rim of the orbit intact. The orbital floor is commonly involved although occasionally the medial wall may be implicated. A blow-out fracture of the orbital floor is characterised by periorbital swelling and haemorrhage, surgical emphysema of the orbital and cheek tissues and infraorbital paraesthesia or anaesthesia. The patient may experience diplopia in any position of gaze but particularly on looking down or up. Entrapment of the inferior orbital contents in the fracture may result in limitation of passive movement of the globe. X-rays of the orbit with appropriate tomography will identify the nature and extent of the blow-out fracture. Systemic antibiotics should be prescribed and the patient observed. Orthoptic assessment is useful. If there is persistent severe enophthalmos or diplopia, surgical exploration and reconstruction of the inferior orbital wall may be necessary. The incarcerated tissue is mobilised and the defect closed using either a thin metallic or plastic plate fixed to the orbital floor.

In the vast majority of blow-out fractures, the orbital swelling resolves in a few weeks and ocular movements return to normal or near normal. If diplopia persists over a long period of time, extraocular muscle surgery may be required to achieve a comfortable field of binocular single vision in the primary position and downgaze.

F. OPTIC NERVE INJURIES

Optic nerve injuries usually accompany head injuries with or without fracture of the upper face and skull. There is sudden loss of vision, ipsilateral dilatation of the pupil and after a few weeks, optic atrophy becomes apparent. X-ray generally confirms a fracture of the middle third of the face and occasionally a bony abnormality of the optic canal. Surgical repair has generally been unrewarding and treatment should be restricted to the use of systemic corticosteroids to reduce nerve oedema and relieve pressure on the intracanicular portion of the optic nerve.

G. INJURIES OF THE LACRIMAL APPARATUS

The lacrimal gland is only rarely involved in injuries and no treatment is usually required; complications are rare. On the other hand, injuries to the lacrimal canaliculi and sac are common and require careful evaluation and repair. In general, as long as one canaliculus remains patent epiphora will be only marginal. A torn or ruptured canaliculus should be repaired by simple apposition of the ruptured ends. Injuries to the lacrimal sac can be directly repaired and carry a good prognosis if the canaliculi are not involved. Occasionally a dacryocystorhinostomy may be necessary if a distal obstruction of the lacrimal passages develops.