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Ocular Trauma

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ABSTRACT
Ocular trauma is one of the important causes of unilateral blindness and visual impairment across the world. In developed countries, most injuries are accidental, while assaults predominate as a cause in developing countries. Trauma may result in various forms of ocular injuries, ranging from minor insult to major functional impairment. Any ocular structure may be involved, and a careful, systematic approach to the examination of a patient is essential to avoid missing occult injury and resultant visual impairment.
KEYWORDS: *Lacerations of the eyelids, foreign bodies, corneal abrasions and erosions, globe rupture, chemical injury.*

INTRODUCTION

Trauma is the most important cause of unilateral blindness in the world [1,2]. Up until the end of the last century, it accounted for approximately 1.6 million cases of blindness, 2.3 million cases of bilateral visual impairment and 19 million cases of unilateral vision loss worldwide[1]. The cause of the injuries varies. Work-related accidental injuries are prevalent in developing countries, while assaults are an important cause in developing countries [1,2,3]. Males are at higher risk than females (4:1). Most commonly involved age group is between 18- 45 years [2]. Injuries range from mild to severe, and can affect any anatomical structure of the eye. Quick assessment and expert management is very essential to preserve the vision.

Approach to the Patient

The evaluation of ocular trauma should include a focused history, systematic examination and appropriate special investigations. A good detailed history is valuable in anticipating and determining the nature and severity of the injury. Many injuries occur in the workplace. It is important to obtain information on the circumstances of the incident, as well as the use of appropriate protective eyewear [4,5]. The mechanism and object involved inform the nature of the tissue destruction. Blunt objects result in tissue contusion, and if severe, may cause globe rupture, while sharp objects cause lacerating and penetrating injuries. The exact time of the injury is also important in determining the treatment strategy [5]. It is important to remember that any anatomical structure may be involved.

Basic evaluation involves inspection, which may be facilitated by the use of local anaesthetic drops and a speculum (if lid swelling is present). Visual acuity should be measured and documented as it is the most informative measure of ocular function, and is a prognostic factor in severe ocular trauma [4,5]. Eye movements should then be checked to determine deficits in ocular motility. An ocular movement exam should be omitted if the patient is suspected of having an open globe injury, in order to prevent prolapse of the intraocular contents. Each anatomical structure of the eye should then be examined with the aid of a good light source. Examination should begin with the lids and skin,

followed by careful examination of the conjunctiva, cornea and sclera. If a corneal abrasion is suspected, the instillation of fluorescein drops will help to confirm the diagnosis [4]. Pupil responses should be tested and a note made on the presence of a relative afferent pupil defect. It should then be determined if there is red reflex, followed by fundoscopy. Imaging is a useful adjunct for further evaluation of the patient. Following blunt trauma, orbital and skull X-rays are useful in confirming fractures of the orbital wall and cranium. Orbital X-rays are also useful in verifying the presence and location of intraocular foreign bodies. Patients who have sustained penetrating injuries will require a computed tomography (CT) scan of the head to exclude possible intracranial injury [4,5]. Minor injuries can be managed at primary care level, while severe injuries require referral to a specialist for further treatment.

Common eye injuries:

Lacerations of the eyelids (Figure 1)

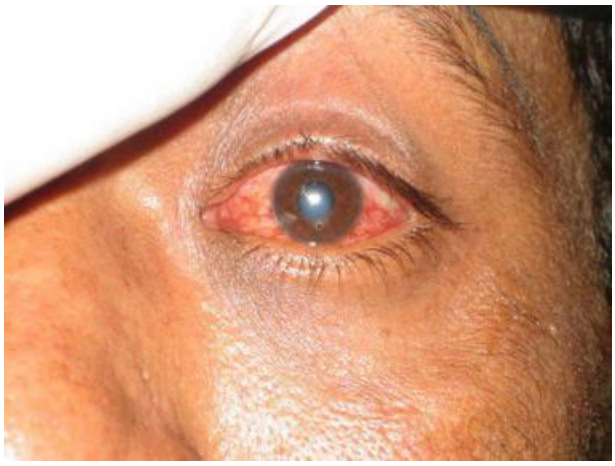
The eyelids may be lacerated or avulsed, depending on the object causing injury like with sharp object , laceration occurs and by blunt object injury avulsion occurs [6,7]. These injuries may or may not involve the lid margin. Human and dog bites to the eye can also cause tissue loss, requiring the need for tissue grafting [5,7]. All three layers of the lid (skin, orbicularis and tarsal plate) may be involved. Repair requires careful anatomical realignment of these structures to prevent lid notching [5]. It is important to exclude possible globe penetration [5,7] in cases of sharp object injury, particularly in the presence of a full-thickness laceration. Lacerations involving the medial canthal area may also involve the nasolacrimal apparatus, leading to a chronic "watery" eye if not repaired [5,6]. Lacerations resulting in full-thickness injury, and its improper surgical management leads to incorrect realignment of the tarsal plate which may result in a lid margin notch which can cause chronic corneal irritation and scarring [5].

Abnormal Eye Movements

Blunt or sharp injury can lead to abnormal ocular movements. It can be due to direct injury to the extraocular muscles (contusion or laceration), or due to mechanical infringement on the muscle (haematoma, blowout fracture or an orbital foreign body) [4]. Subperiosteal haematoma is a result of bleeding into the subperiosteal space, commonly following blunt trauma in children and young adults. Classical presentation is with downward proptosis, with an otherwise normal eye. A CT scan is useful to confirm the diagnosis and visualise the blood collection. Patients should be referred for drainage of the collection [4]. Blowout fractures result from blunt-force injury to the orbit, the transmitted force causing fracture of the weakest points of the orbit, mainly the floor and medial wall [4,8]. Clinically, the patient will have elevation deficit (due to entrapment of the inferior rectus in the fracture), loss of sensation at areas supplied by infraorbital nerve and subcutaneous crepitus [4]. Facial X-rays or a CT scan will show opacification of the maxillary sinus due to herniation of the orbital contents and entrapment of the inferior rectus [8] with characterstic "tear drop sign". The patient should be referred to an ophthalmologist or maxillofacial surgeon for repair. Orbital foreign bodies can also cause mechanical restriction [4,8]. The limitation of movement will depend on the site of the foreign body and the affected muscles. A CT scan is investigation of choice to detect the presence of an orbital foreign body. Patients should be referred for removal of the foreign body.

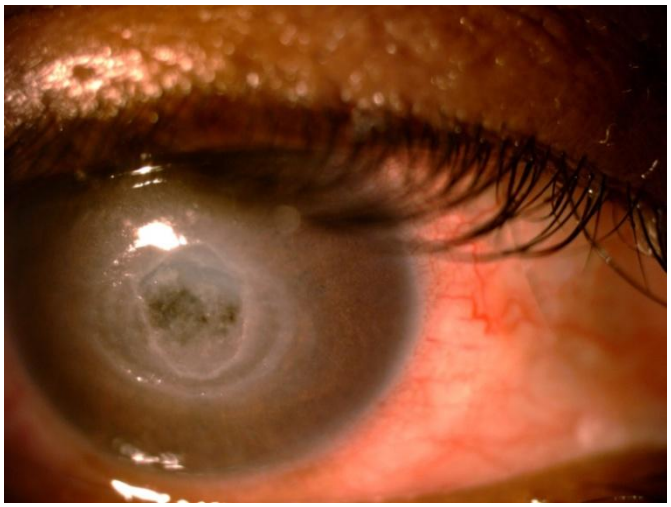
Foreign Bodies (Figure 2):

Common activities resulting in ocular injuries by foreign bodies are grinding, hammering, drilling and sawing. Foreign bodies can either be found on the conjunctiva (bulbar and tarsal) or cornea (Figure), or may be intraocular. It is important to take a detailed history of the exact mechanism of injury and materials involved in order to know what type of injury to expect [3,4,6]. Activities such as grinding result in low-velocity projectiles which often embed in the conjunctiva or cornea, while higher-velocity shrapnel, e.g. from hammering, is more likely to penetrate the globe and lodge intraocularly [4]. Patients will complain of a foreign body sensation. The affected eye will be red, painful and photophobic. The foreign body may be clearly seen as a dark spot on the conjunctiva or cornea (Figure). It may also be lodged in the tarsal conjunctiva, and can be missed if the lids (especially the upper lid) are not everted [4,6]. Fluorescein staining is useful in these cases when searching for linear corneal abrasions that may result from a subtarsal foreign body rubbing against the cornea. Conjunctival foreign bodies may be removed with a 26 G needle, following the instillation of local anaesthetic drops. Corneal foreign bodies may be removed similarly after liberal use of topical anaesthesia. If the foreign body persists, then the patient should be referred to an ophthalmologist. X-rays (or a CT scan, if available) are useful imaging modalities to confirm diagnosis and the location of an intraocular foreign body. Cases of intraocular foreign bodies must be referred to an ophthalmologist for further management. Missed foreign bodies can result in conditions such as endophthalmitis, particularly if organic matter is involved, or siderosis bulbi, if iron is involved [4,6]. Metallic foreign bodies, particularly iron and copper, are toxic to the retina and cause yellow-brown discolouration of the ocular tissue.



Corneal abrasions and erosions (Figure 3):

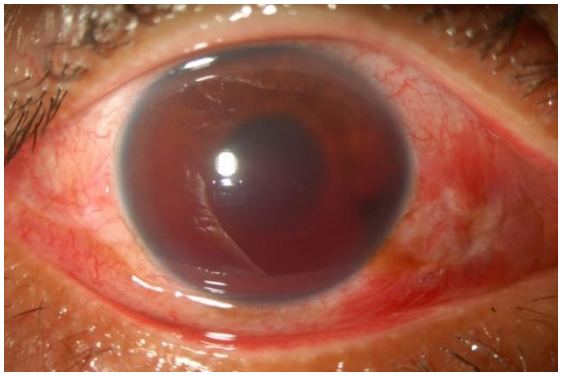
Abrasions and erosions of the cornea are very common ocular injuries [6,9]. Abrasions are caused by scratches from minor trauma, i.e. by fingernails and sand. Erosions occurs as a result of excessive ultraviolet (UV) exposure, with resultant epithelial damage, such as due to tanning on sunbeds, without wearing protective goggles. These lesions tend to be painful as a result of epithelial loss and exposure of the underlying nerve endings [4]. Patients present with a history of minor trauma to the eye or of excessive UV exposure. The affected eye or eyes are red and painful, and there is excessive lacrimation [4,9]. Fluorescein drops should be instilled to allow confirmation of the epithelial injury. A single linear defect is often seen in abrasions, while erosions tend to result in multiple punctate lesions [4]. Corneal epithelial recovery is rapid, and the management of abrasions and erosions essentially involves pain relief and infection prevention [4,6,9]. Cycloplegics should be prescribed to relieve associated ciliary spasm, analgesics for pain, and antibiotic ointment used as prophylaxis against secondary infection, while padding of the eyewill reduce discomfort from blinking and may aid corneal healing [4]. They must be advised to wear UV protection as a preventative measure. While local anaesthetic drops provide immediate pain relief, they should not be prescribed for patients to take home. A local anaesthetic inhibits corneal healing, and will make the patient unaware of any further insult to the cornea [4,9].



Penetrating injury or globe rupture (Figure 4):
A sharp or severe blunt injury can result in globe disruption [4,10]. Most injuries will be easily detected on simple inspection. However, some injuries can be notorious to detect, if there is not a high index of suspicion, then sight-threatening injuries may be missed [4,5]. Signs of globe disruption include reduced visual acuity, distortion or an abnormally shaped pupil with poor pupillary response (D-shaped pupil due to iridodialysis), prolapse of the uveal tissue at the wound site, poor red reflex as a result of vitreous haemorrhage, hyphaema (blood in the anterior chamber) or retinal detachment, and an anterior chamber that appears deeper than the normal, fellow eye [4,5,10]. A high index of suspicion of globe penetration must be maintained for full-thickness lid lacerations, as well as sharp object injuries around the periorbita [4]. Management requires referral to an ophthalmologist within 24 hours for globe repair. While awaiting ophthalmology referral, drops should not be instilled in the eye. This is to prevent potentially toxic preservatives from affecting exposed intraocular tissue. A shield should be placed over the eye, without an underlying pressure dressing, in order to avoid further prolapse of intraocular content [4]. Patients with open globe injuries will require a CT scan of the head to exclude retained foreign material, as well as intracranial injury.

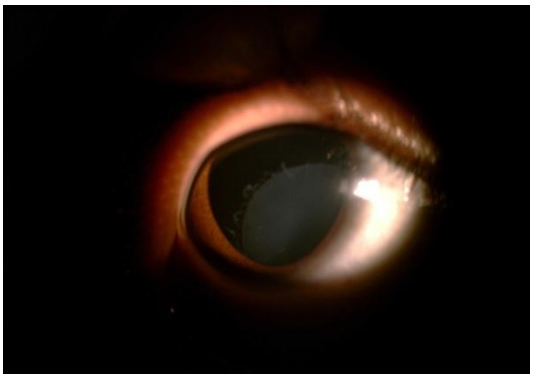
Traumatic vascular events (Figure 5):
Subconjunctival haemorrhage is common after minor trauma, coughing or valsalva manoeuvres [4]. It can also occur spontaneously in patients with hypertension, bleeding diathesis or those on anticoagulant medication [6]. It presents as a red area on the bulbar conjunctiva, which is easily identifiable as blood. It is usually painless. Management is often conservative provided the visual acuity, pupillary response, eye movements and fundus examination are all normal, and there are no signs of globe rupture. Patients with bilateral subconjunctival haemorrhage and an inability to identify the posterior extent thereof may be associated with an anterior base-of-skull fracture [4]. Hyphaema usually occurs after blunt trauma, and its severity can vary from mild to an anterior chamber filled with blood; the so-called "8-ball" hyphaema [4,11]. Vision may be reduced according to the severity of the injury. Patients may experience pain, particularly if the intraocular pressure is raised. Most commonly, a fluid level of settled blood can be seen in the inferior part of the anterior chamber. Hyphaema can be complicated by a rebleed which most commonly occurs in the first five days following the initial bleed, and blood may also obstruct the trabecular meshwork, resulting in elevation of the intraocular pressure [4,11]. Prolonged raised intraocular pressure may result in corneal staining and optic atrophy. Thus, patients must be referred to an ophthalmologist within 24 hours to avoid these complications. Carotid cavernous fistula most commonly occurs as a result of penetrating eye injury, but may

follow blunt trauma, particularly with base-of-skull fractures. There is direct arteriovenous communication between the internal carotid artery and the cavernous sinus. Patients present with conjunctival chemosis and dilated vessels, a pulsatile proptosis and a bruit on auscultation. A CT angiogram will confirm the diagnosis, and these patients require neurosurgical referral for embolisation of the fistula in order to prevent glaucoma, optic nerve and retinal damage [4].



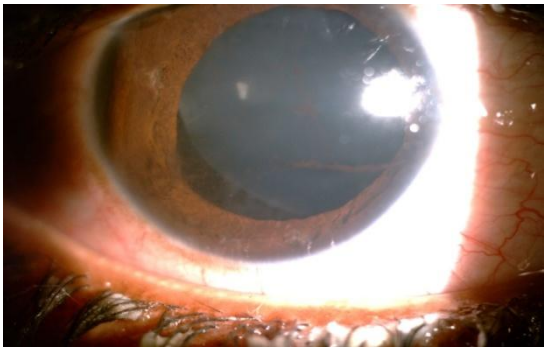
Lens AND Iris injuries:

Blunt trauma, can result in iris sphincter and lens zonular injury [12]. The lens may then become partially displaced (subluxated) within the pupillary zone (Figure), or dislocate completely (Figure), either into the vitreous or the anterior chamber [4,12]. Anterior lens dislocation can cause trabecular outflow obstruction leading to elevated intraocular pressure. If it is observed that the lens has dislocated into the anterior chamber, and the eye feels hard and the patient has pain, referral to an ophthalmologist is necessary, usually within 24 hours for lens extraction [4]. Acetazolamide 500 mg BD orally should be administered in these cases, until an ophthalmologist sees.



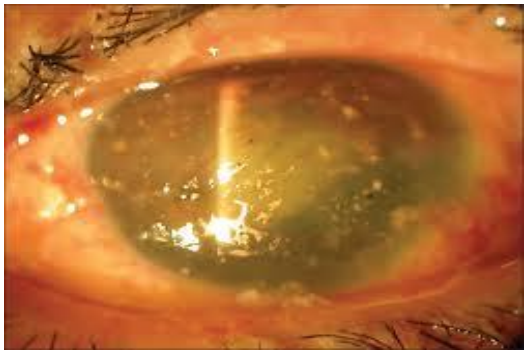
Blunt injury or penetrating injury to lens can lead to cataract also (Figure) and coming of lens matter in anterior chamber (Figure). Lens particles in anterior chamber may block trabecular outflow leading to raised intraocular pressure.

Iris injuriy can lead to Iridodialysis (Figure), Cyclodialysis. In these isolated cases, there will be decreased IOP due to increases aqueous outflow.



Chemical Injury

Chemical injuries most commonly occur in the workplace when adequate eye protection is not used [4,6,13]. Immediate management should be instituted prior to referral to an ophthalmologist for formal assessment [4,6]. The most common offending agents are alkaline in nature (commonly detergents and cleaning agents), followed by acids and particulate chemicals [13]. Alkalis are more likely to result in serious ocular damage (Figure) since these agents can readily diffuse through the cornea by saponification to cause intraocular damage. Acidic agents tend to cause surface coagulation which prevents further penetration [4,13]. Chemical damage can range from mild to severe corneal and intraocular injury, resulting in visual loss. Roper Hall classification is used for grading the injury. The mainstay of treatment is copious irrigation of the affected eye [4,13]. Local anaesthetic drops should be instilled. The lids may need to be held open and the eye irrigated for at least 30 minutes. If readily available, litmus or pH sticks can be used to determine the nature of the agent, but this should not delay irrigation. The fornices must be swept with a cotton bud to remove particulate matter. Patients should then be urgently referred to an ophthalmologist for further evaluation and management.



Conclusion

Ocular trauma is an important cause of visual impairment and unilateral blindness. The majority of injuries tends to be minor and can be managed in the primary healthcare setting. Knowledge of ocular anatomy, as well as careful examination, is crucial in the identification of vision threatening injuries. Features of severe injury include marked visual loss and a relative afferent pupil defect. Imaging modalities should be used in cases of severe injuries as a routine. If there is any doubt as to the nature and extent of the injury, patients should be referred to an ophthalmologist.

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