Ocular trauma is the most common cause of monocular blindness in children. The visual loss that occurs in ocular trauma in childhood is not only due to damage caused by the trauma itself but also due to resultant amblyopia after surgery. In children, trauma is the second most common indication for ocular surgery after strabismus. Both open and closed globe injuries along with orbital and adnexal trauma has been described.

Most paediatric ocular trauma reported from the west was sustained either at home, in motor vehicle accidents or due to fireworks. In the 11-15 year age group, boys with ocular trauma outnumbered girls. Orbital fractures were commonly seen with midfacial injuries. Even facial lacerations that seemed trivial on initial examination were associated with severe ocular trauma, hence the importance of careful evaluation of the globe in midfacial injuries.

In a large series reported from India, 80% of children sustained injuries in the rural setup. Outdoor sports including homemade bow and arrow caused ocular injuries in about 50%, household items like kitchen knives, door handles, pencil tip, and wire in 15%, fireworks in 10%. Closed globe injuries have even been reported with carbonated beverages and detergents. In injuries associated with fireworks, the eyeball is the most common body part involved, both in direct injury and in injuries to bystanders.

Serious (Gr IV) chemical burns and loss of vision in the eye have been caused by wall plastering material and the concentrated Ca(OH)2/CaCO3 used to spice up betel leaf eaten at home, falling into the eye. Babies being breast fed have sometimes shown lid lacerations due to the hook of the mothers clothing.

**Evaluation Of The Child With Ocular Trauma**

Most children with eye or adnexal trauma will present to the paediatrician or emergency medicine department. The first contact physician should

1. Elicit a proper history. An older child may/may not offer a proper history in order to cover up for a forbidden activity (e.g. fireworks etc) and the parent may not always know the exact agent of injury (stick, wire, ball) if known is useful to assess the type of injury expected. The approximate timing of sustaining injury alerts the ophthalmologist to the possibility of endophthalmitis, specially in injuries with vegetable foreign bodies like wood etc. Again rural setting injuries have a higher incidence of infection. The identity of chemical agent is very important in chemical injuries as immediate treatment is required to contain the extent of damage.
2. History of previous ocular surgeries, previous ocular injuries, the visual acuity of both eyes prior to injury and the history of systemic conditions like bleeding disorders is important from the point of view of surgery and the visual rehabilitation of the child.

**Examination Of The Child With Ocular Trauma**

After ensuring that the child’s vital signs are normal, attempt must be made to

1. Elicit all the external injuries including facial injuries and lid lacerations causing proptosis/endophthalmitis or ecchymosis. An older child may allow the examiner to record vision (unaided and pinhole) with a vision chart or counting fingers. Gentle retraction of the lids must be done even if lid edema is present, to look for open globe injuries and pupillary reactions for detecting traumatic optic neuropathy.
2. If the child is small and resists any attempt at examination, it is preferable to examine the extent of injury under general anaesthesia and proceed with the repair in the same sitting. Till then placing a sterile pad and bandage over the injured eye is advisable. Use of unsupervised sedation by the ophthalmologist to determine the extent of injury is not advisable as some sedatives specially midazolam is known to cause respiratory depression and in the absence of emergency resuscitation kit, a child with a minor eye injury may land up in the ICU with a severe hypoxic brain damage.
3. If the first examination reveals or suggests a serious open globe injury needing surgical intervention, then the child is admitted and kept nil orally. Intravenous antibiotics are started and the child is posted for primary surgical exploration.
or repair under general anaesthesia at the earliest available opportunity. Appropriate radiographic investigations, ideally a CT scan of brain and orbit must be ordered.

4. Animal bites should be cleaned thoroughly, antirabies immunisation administered and systemic antibiotic coverage given. Amoxycillin clavulanate is appropriate coverage, but in penicillin allergic patients azithromycin with clindamycin or septran offers a equivalent coverage.

**Eyelid And Adnexal Trauma**

Eyelid injury can be isolated or in conjunction with other ocular trauma. Upper eyelid injuries extending deep into the forehead should be explored and if any underlying fracture is suspected, the help of a neurosurgeon should be sought. The repair of eyelid injuries alone can be delayed up to 36-48 hours as this allows the oedema to subside and allows better identification of anatomical landmarks. Medial canthal tears can involve the canaliculus and this should be identified and repaired, if necessary around a silicon tube. In children it is preferable to use absorbable sutures, plain catgut or vicryl to avoid another exposure to anaesthesia for removal of the sutures. If used, superficial non absorbable sutures are removed on 5th or 6th day (earlier than in an adult) to prevent scarring.

**Orbital Trauma**

Orbital fractures are common in children suffering head and face trauma. The type of fracture, mechanism of injury and timing of possible treatment differ from that of adult population. The most common orbital fracture in childhood is of the orbital roof which is rarely fractured in adults. Indications for surgical repair include severe restriction of ocular motility, diplopia, persistent pain, nausea and vomiting. These are less likely to resolve in a child than in an adult.

Timing of surgical repair- Most studies recommend surgical intervention within 5-7 days of the injury in children versus 2 weeks or longer in adults. A study by Matteini et al recommends a classification system of orbital fracture in children based on the clinical, radiographic and prognostic criteria (table-I). They suggest that the surgical timing of these fractures relates to the anatomical location, CSF leak or penetrating wounds, patients age, muscle entrapment or signs of ischemia or compression of optic nerve. While type-V fracture needs surgical treatment within a few hours, type-IV should be treated within 24 hours, type III within a few days.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Fracture of orbital rim</td>
</tr>
<tr>
<td>II</td>
<td>Fracture of orbital wall with no functional impairment</td>
</tr>
<tr>
<td>IIIa</td>
<td>Fracture of orbital wall with diplopia, adults</td>
</tr>
<tr>
<td>IIIb</td>
<td>Fracture of orbital wall with diplopia, children</td>
</tr>
<tr>
<td>IV</td>
<td>Fracture with open wound, penetrating object, CSF leakage</td>
</tr>
<tr>
<td>V</td>
<td>Fracture of orbital apex, fracture causing compression of globe, ischemia of optic nerve</td>
</tr>
</tbody>
</table>

Adapted from Matteini et al. [14]

**Ocular Trauma-Anterior Segment**

Anterior segment injuries in children can range from minor abrasion to open globe injuries with extrusion of intraocular contents and severe chemical burns with 3600 limbal ischemia. An area of subconjunctival hemorrage, chemosis or a small break in the eyelid skin may be the only surface manifestation of scleral perforation by a sharp pointed object such as a knife, scissor or blade. A peaked pupil may be the only evident sign of a small corneal or limbal perforation and if a retained intraocular foreign body is suspected, a CT scan of the orbit should be done.

Corneoscleral wounds are repaired on the same principle as adults. These wounds heal relatively early in children, hence sutures should correspondingly be removed early in children. Fibrin clots form quickly in the anterior chamber of a child’s eye after penetrating injury to the cornea and these can often simulate the appearance of fluffy cataractous lens cortex. Lens removal therefore, should be avoided at the time of primary repair to avoid rendering the eye unnecessarily aphakic, thus risking amblyopia. Even if lens cortex is exposed, postponing cataract surgery for a week or two until severe post traumatic inflammation subsides may result in a smoother post operative recovery with reduced risks of complications.

The management of traumatic hyphema in children can be difficult, but most studies recommend adequate inpatient management to prevent rise of IOP and to prevent secondary hemorrhage and corneal blood staining. Patching however is avoided to prevent amblyopia. Medical management with corticosteroids and cycloplegic drops with IOP lowering drugs is recommended. Aspirin containing drugs are to be avoided. Systemic use of EACA has shown to reduce the rate of rebleeding in traumatic hyphema in children.

This has been confirmed by a study done by Pieramice et al. Early (3-4 days) surgical evacuation of a total hyphema has been advocated in children because of difficulty in measuring IOP and detecting early corneal staining. Children with sickle cell anemia tend to have complications
of hyphaema like blood staining at lower IOP.\textsuperscript{15} Other causes of spontaneous hyphaema like intraocular tumours, juvenile xanthogranuloma and bleeding disorders should be ruled out by doing blood counts, bleeding parameters and a CT scan.

**Ocular Trauma - Posterior Segment**

Posterior segment injuries including retinal detachment, vitreous haemorrhage, endophthalmitis, optic nerve avulsion have a devastating effect on the vision of the injured eye in patients of all age groups but the possibility of amblyopia in children below 8-9 years increases the visual morbidity in them. Retinal detachment in children with ocular trauma is caused more by compression/decompression of globe with lower sclera rigidity than the penetrating or perforating injury itself.\textsuperscript{19}

Post traumatic endophthalmitis is a poor prognostic indicator for final visual outcome in children with ocular trauma. Delay in treatment due to an increase in lag period in children with ocular trauma from rural areas in our country has increased the risk of endophthalmitis causing poor visual recovery. Prophylactic antibiotics has been shown to decrease the rate of endophthalmitis after sustaining ocular trauma in children with risk factors.\textsuperscript{4}

Cranial nerve palsies including 3rd, 4th and 6th nerve are often found in conjunction with ocular and head injuries in children.

Traumatic optic neuropathy may be the only ophthalmic injury sustained after a closed head injury. The absence of history of visual loss in children and the difficulty in recording visual acuity at presentation and eliciting a Relative Afferent Pupillary Defect in swinging flash light test in an uncooperative child often makes diagnosis of traumatic optic neuropathy difficult in children. Forces transmitted through the thin skull bones of children cause injury to the canalicular (fixed) part of the optic nerve in children. The visual outcome with any form of treatment of traumatic optic neuropathy -high dose of corticosteroids, optic nerve decompression is the same as that for adults.

**Prevention And Conclusion**

As children are very curious by nature and often exhibit naïve behaviour, even activities which would otherwise be considered harmless can cause ocular trauma in children. Children tend to play unsupervised with dangerous toys like guns and with fireworks without taking adequate protective measures. The prognosis in traumatized eyes in children being guarded, prevention is critical in reducing the ocular morbidity in children. Successful preventive measures depend on a vigilant awareness of activities and situations in which the children could get injured. Most ocular injuries of children occurring in predictable situations are preventable. The National society to prevent blindness estimated that the frequency and severity of at least 90% of all eye injuries could be prevented.\textsuperscript{21} Inadequate adult supervision is an important contributing factor in most cases of childhood eye injuries. Ophthalmologists should educate parents and children about the kinds of hazards that can result in needless eye injuries and encourage them to take preventive measures. All one eyed individuals should mandatorily wear protective eyewear.\textsuperscript{22} Since a high percentage of eye injuries occur at home and are caused by sharp objects, special safety standards should be applied with regard to dangerous furniture or toys. Lectures in schools and special programmes on the subject of eye injury via television and other media may assist in achieving this goal. Such educative attempts will definitely bring down the incidence of eye injury in children.

**References:**


