

Management of Eye Trauma

HISTORY

- Pre-existing eye abnormalities. Does child normally wear glasses or contact lenses?
- Possible exposure to foreign body.
- Symptoms: photophobia, eye pain, blurred vision, diplopia (*monocular* from lens dislocation or retinal injury, *binocular* from muscle injury or entrapment, nerve injury, orbital oedema)

EXAMINATION

a) In multi-trauma, exclude *tense proptosis* due to retrobulbar haematoma, and *optic nerve dysfunction* (pupils and acuity) as a matter of urgency. Check eye movements.

b) **Lids closed:** Profile (proptosis, enophthalmia) – difficult if gross periorbital swelling.
Entry wounds, lacerations, foreign bodies.
Ecchymoses.

Lids open: Even if only open a fraction, a useful assessment can be made (consensual reflexes and acuity). May need to use a warm compress to loosen any discharge holding eyelashes together. *Avoid pressure on the eyeball.*

c) **Vision testing:**

- At very least document *light perception* (including through closed lids; or a reflex contraction of closed lids may be seen).
- Visual acuity**
 - The most important assessment, done before any interventions, except in major trauma or caustic exposure.
 - Document each eye separately so that testing can be reliably repeated. Document method used to test, as well as the distance.
 - Can document an infant fixating and following a toy, an older child counting fingers at a specific distance, or using a Snellen Chart (document distance).
 - Optimal acuity testing is with a distance Snellen Chart (6 meters)
 - Child with refractive error wears glasses for testing, or if glasses not available, uses pinhole.

Pinhole testing:

- hole, or cluster of holes, made in piece of card using 18-gauge needle.
- acuity will only improve with pinhole if a refractive error (pre-existing, or corneal abrasion) is the cause of loss of vision.
- maximal improvement through a pinhole may only be up to 6/7.5 or 6/9.

- A difference between eyes of more than 2 lines of the chart is probably more important than absolute acuity and suggests unequal refractive error, amblyopia or trauma.
- In acute trauma, normal near vision can be assumed if distance vision can be documented.

Age-specific acuity levels for screening:

	<u>Minimum</u>	<u>Maximum</u>
3 years:	6/15	6/9
4 “	6/12	6/9 - 6/6
5 “	6/9	6/6

Example:

A 3 year old can see at 6 metres what an adult can see at 15 metres

- d) **Pupils:**
- Shape, response, distortion, projection of uveal tissue, difference in size.
 - Mydriasis (dilated pupil) may be post-traumatic, due to atropine-like drugs or a 3rd nerve lesion. (Pilocarpine will constrict a mydriatic pupil caused by a 3rd nerve lesion, but may not one caused by pharmacological agents.)
 - Swinging flashlight test: very sensitive for optic nerve injuries. Light is swung from eye to eye; after a few "swings" the eye with an afferent (sensory) defect will appear to dilate when illuminated.
- e) **Globe:**
- **Conjunctiva:** Injection of bulbar conjunctiva.
Perilimbal (ciliary) injection indicating significant trauma.
Chemosis (conjunctival oedema).
Conjunctival laceration or foreign body.
Subconjunctival haemorrhage or emphysema (associated with fracture of medial wall of orbit).
 - **Cornea:** "Cloudiness" (oedema), laceration, foreign body, abrasion, iris prolapse.
 - **Anterior chamber:** Unusual shallowness or depth, hyphaema (blood in anterior chamber), hypopyon (pus in anterior chamber).
 - **Eye movements:** Limitation? (blow-out fracture; orbital cellulitis)
Pain on movement (globe rupture; foreign bodies)
 - **Palpate orbital rim:** Tenderness, step-off? Unstable facial fractures?
Sensation over cheek (fracture of inferior wall of orbit may injure the infraorbital nerve). Proptosis (retro-orbital haemorrhage), enophthalmia (orbital contents may sink with a blow-out fracture).
- f) **Posterior segment of the eye:**

Before pharmacological dilation of a pupil, one must first exclude:

- i. **Ruptured globe:**
 - shallow anterior chamber
 - chemosis
 - distorted pupil
 - hypotonia (↓ globe pressure)
- ii. **Hyphaema:** This includes microhyphaema, red cells seen in the anterior chamber with slit lamp.

For dilation use: Tropicamide 1% (add cyclopentolate 1% if iris is brown)

- **Red reflex:** *Absence of red reflex may indicate obstruction within the eyeball to the passage of light (intraocular haemorrhage, cataract, corneal scar). A dark reflex may be due to small pupils, a refractive error, strabismus, or an intraocular lesion (recheck after pharmacological dilation).*
- **Fundoscopy:** If vitreous is clear and there is good visualisation of the retina, there is unlikely to be globe rupture (rupture causes significant vitreous haemorrhage and possibly hyphaema). The exceptions are small penetrating injuries, particularly of the limbus. Maximise pupil size by using dim ambient light and the small circle ophthalmoscope.
- **Slit lamp:** Often difficult in the under 3 year age group. If difficult, abandon slit lamp and use ophthalmoscope to obtain as much information as possible.

Causes of perilimbal (ciliary) injection

1. Acute iritis
2. Keratitis
3. Glaucoma
4. Any infection
5. Mild chemical burns

Eye pain relieved by topical anaesthetic drops implies an ocular **surface** problem involving the conjunctiva or cornea.

OCULAR TRAUMA

Clinical considerations are based on the presenting history. The nature of the injury gives important clues to the type of eye involvement to look for.

- 1. Blunt trauma with large objects** (sporting equipment, fists). A common scenario with many possible outcomes:
Corneal abrasion, hyphaema, vitreous haemorrhage, retinal haemorrhage, retinal oedema, choroidal breaks, retinal breaks, globe rupture (may be occult), retrobulbar haemorrhage, periorbital (blowout) fractures.
- 2. Trauma with sharp objects** (wire, sticks, glass) and reasonable force (thrown, fallen onto, flicked). High chance of *ocular penetration* – must be excluded by careful examination.
- 3. Small, high velocity objects** (hammering metal or ceramic). Ocular penetration. Be suspicious of retained intraocular foreign body even if very little evidence of external damage, and investigate appropriately (X-ray, CT).

- *Once a penetrating eye injury is diagnosed, defer further eye examination until theatre.*
- *If there is any doubt about ocular penetration, contact the ophthalmologist.*

SPECIFIC EYE INJURIES

- 1. Periorbital ecchymoses** are due to direct *soft tissue trauma* (usually benign, but may be associated with globe injury), or due to *facial fractures* or *basal skull fractures*. If benign and not associated with a fracture, can be treated with ice packs.
- 2. Orbital fractures** are characterised by *restriction of extraocular movement*. 20% of cases are complicated by *globe injury*, and the rare associated *compressive optic neuropathy* is an ophthalmological emergency (check acuity and pupil responses). All cases of orbital fracture should be reviewed by an ophthalmologist, and orbital CT scan should be performed to define the injury.
- 3. Lid lacerations:** obtain ophthalmological opinion for any laceration involving the *medial 1/3 of upper or lower lid* (may involve the lacrimal system), the *tarsal plate, lid margins* or *canthi* (may result in lid deformity and abnormal movement), or *ptosis*. Minor lacerations superficial to the tarsal plate may be repaired in ED. Ensure normal lacrimal drainage – epiphora (tears spilling over lid margins) may be due to lacrimal duct injury.
- 4. Conjunctival lacerations** if small are treated with topical antibiotic drops only.
- 5. Subconjunctival haemorrhage** may occur with minor trauma or any stimulus that raises intraocular pressure (eg vomiting). There is no loss of visual acuity and resolution will occur over 2 weeks (warn parents about dramatic colour changes). *In the presence of significant blunt trauma, subconjunctival haemorrhage may hide a scleral rupture.* Recurrent haemorrhages should be treated with suspicion: exclude non-accidental injury, bleeding disorder etc.
- 6. Corneal abrasion** causes foreign body sensation, pain, photophobia, marked blepharospasm and injected sclera. Initially instil a topical anaesthetic, then fluorescein into conjunctival sac. In a dark room, examine under a Wood's lamp, cobalt blue of slit lamp or blue light of an ophthalmoscope. "Ice rink sign" (multiple vertical striations) usually indicates a foreign body still under the upper lid. Use topical antibiotics (*chloramphenicol*) and review daily. The use of an eye patch is no longer recommended. Several drops of mydriatic (cyclopentolate 1-2%, homatropine 2-5% or tropicamide 1%) decrease ciliary spasm, provide comfort and can be used at home.

Large corneal abrasions and those involving the visual axis should be followed up by an ophthalmologist within 24 hours.

Beware of an apparent corneal abrasion in the absence of history of trauma! This may be due to herpetic dendrites in a patient with concurrent herpes infection at other sites. In such cases there is usually absent / reduced corneal sensation on the affected side (The affected cornea will be anaesthetic to light touch when brushed with a wisp of cotton).

7. **Corneal foreign body** is associated with foreign body sensation. Anaesthetise the cornea (amethocaine) and evert lids. Wash off a superficial foreign body using saline flushed through a cannula (needle removed), or wipe off with a cotton bud soaked in anaesthetic. In older, cooperative children with shallow penetration of foreign body, use slit lamp and the wooden end of a cotton-tipped applicator. Check for further foreign bodies (including under the lids) and abrasions, instil a mydriatic and topical antibiotic, and review in 24 hours in the Emergency Department. Consult ophthalmologist if the foreign body penetrates the corneal stroma, or if diagnosis is uncertain. Permanent rust rings may result from iron containing foreign bodies and may result in decreased acuity and photophobia – refer to an ophthalmologist.
8. **Laceration of the sclera or cornea** is associated with decreased visual acuity, opacity of the cornea, abnormal anterior chamber (shallow depth or hyphaema). Use Seidel's test to identify scleral laceration underlying a conjunctival laceration. Fluorescein is placed on the point of interest, and the eye examined under the cobalt blue light of the slit lamp. Swirling dilution of the fluorescein denotes leaking aqueous humor. Laceration is most common at the insertions of the extraocular muscles (seen as a subconjunctival collection = chemosis) or at the limbus. With scleral lacerations, the choroid or iris may plug the wound, appearing as blue, brown or black material on the surface of the sclera. In corneal lacerations the iris tends to plug the wound, resulting in a "tear drop" pupil, "pointing" towards the laceration.
9. **Chemical injuries** *Ophthalmological Emergency* – contact on-call eye team urgently
 - a) **Acid or alkali injuries:** Copious irrigation with saline takes precedence. Assess acuity quickly, and then sedate with rapidly acting parenteral agent if necessary. Topical anaesthesia of the eye (amethocaine) may be adequate. A two-pronged nasal oxygen cannula on the bridge of the nose allows bilateral irrigation. IV fluid tubing can be used for unilateral irrigation. Irrigate for at least 20 minutes in the case of acid injury, and continue even longer for alkali injuries. Irrigation may be useful for up to 24 hours after exposure. Evert both lids to wash out any particulate matter, and flush inferior and superior cul-de-sacs. Check pH of conjunctival sac with litmus paper (or a urine dipstick) after 20 minutes of irrigation, and continue irrigation until pH is neutral. If irrigation is ceased, recheck pH after 10 minutes to ensure pH remains stable. Minor caustic injury causes scleral and possibly limbal injection. Severe caustic injury results in a "porcelain eye" due to coagulation of scleral blood vessels and corneal opacity. Never attempt to neutralise acid with alkali, or vice versa, as resultant heat production can cause further injury. (Note: hydrofluoric acid exposure may require irrigation with magnesium oxide solution – contact poisons centre for latest recommendations.)
 - b) **Other chemical injuries:** The sooner irrigation is commenced the better. Obtain poisons centre information on ocular toxicity, and begin irrigation immediately if any delay in information. First aid involves 15 minutes irrigation under a slowly running tap. On arrival in ED if patient has any symptoms continue with a further 1 litre of saline. Assess acuity, apply topical anaesthetic, measure pH, irrigate.
10. **UV keratitis** may result from staring at an eclipse, welder's torch or tanning booth lights. Symptoms usually include photophobia, eye pain, tearing, scleral injection 8-12 hours post-injury. Slit lamp and fluorescein shows diffuse shallow punctate lesions. It is usually bilateral and heals in 24-48 hours with cycloplegia and oral analgesia.
11. **Hyphaema** (blood in the anterior chamber) is usually caused by severe blunt trauma. It may be an obvious layer of blood, be a diffuse red haze which takes hours to settle out, or be microscopic (microhyphaema) and require slit lamp examination to rule it out. Manage with bed rest and head elevated to 45%. Protect the eye with an eye shield, and arrange review by an ophthalmologist (after your initial assessment).
NB: *Hyphaema must always be ruled out before pharmacological dilation of pupils.*
12. **Post-traumatic iritis** presents 24-48 hours after blunt eye trauma with photophobia, eye pain, tearing, blepharospasm and perilimbal injection. *Pain on accommodation is highly suggestive* (ask patient to focus on a distant object, then to quickly focus on examiner's fingers nearby). *Topical anaesthetics do not relieve the pain.* Slit lamp examination reveals white cells and protein in the anterior chamber ("*flare and cell*"). Refer to ophthalmologist (after your initial assessment).
13. **Lens subluxation** may occur either anteriorly or posteriorly, resulting in an abnormally shallow or deep anterior chamber, a visible lens margin and possibly iridodonesis (shaking of iris provoked by rapidly changing gaze). Refer to ophthalmologist.
14. **Intraocular foreign body** – this may be vision threatening. There may be decreased acuity, pupil distortion (teardrop pupil) and relatively little pain. A tear in the iris may produce a "second pupil". Manage with bed rest, a protective eye shield, and refer to an ophthalmologist.

