Corneal Foreign Bodies, Injuries and Abrasions

Immediate action is required for:

Acid or alkali foreign body (chemical burn) - start copious irrigation immediately. See the separate article Eye Trauma for management.

This article covers superficial injuries to the cornea: corneal foreign body (FB), arc eye (welder’s eye) and corneal abrasion.

For other eye injuries, see also the separate article Eye Trauma.

Presentation[^1]

Corneal injuries may be physical, chemical, environmental (eg, ultraviolet (UV) damage) or infective. They are common and painful and patients present early and in discomfort which can be severe. Topical anaesthesia may be required before the eye can be properly examined.

Corneal abrasions are common. There is usually a history of minor trauma from a scratch, grit or contact lens problem. (Abrasions may also arise if the eyelids do not close properly - eg, with neuropathy, proptosis, ectropion or in unconscious patients.)

If there is no history of injury, consider infection - eg, herpes simplex infection, chemical injury and corneal foreign bodies. Patients are usually very good at localising the latter when on the surface of the eye. It is also essential to rule out a high-velocity penetrating injury to the globe with a consequent intraocular FB. These injuries can go unnoticed at the time (eg, when mowing or grinding). Intraocular foreign bodies can have rapidly serious consequences: some (eg, glass) are inert, but others, such as copper, are rapidly destructive to the retina.

History

A detailed history is essential to avoid missing sight-threatening conditions: for young children or unconscious patients - try to get history from a witness and consider the possibility of serious or penetrating injury.

Questions to ask:

- Time and mode of injury.
- What the patient was doing at the time.
- The nature and size of object causing injury (if known); whether it was sharp or blunt; the speed of impact.
- The possibility of a high-velocity injury - eg, from power tools, metal on metal work, hammer and chisel, grinding, lawn mowing, glass injuries, or an explosion.
- Whether glasses or goggles were worn, and what type. If worn, whether they were hugging the eye or with a space where an object could have entered.
- Previous acuity (even if an estimate) and any eye problems.
- Current symptoms - pain, reduced vision, FB sensation, and any other symptoms - eg, diplopia, flashes/floaters.
- Contact lens use - if so, think of a possible corneal ulcer rather than abrasion.[^2]
- Past medical and ocular history - any ongoing eye problems, tetanus immunisation, and allergies.

Symptoms
Corneal injury/laceration may be partial-thickness (abrasion) or full-thickness (penetrating injury). Corneal foreign bodies may occur alone or in conjunction with abrasion/penetrating injury.

**Symptoms of superficial corneal abrasion or corneal FB**

- Redness, pain, watering (usually).
- FB sensation (usually).
- Blurred vision.
- Photophobia.
- Pain on eye movement.
- Patients are fairly reliable at locating the FB.[3]

There may be no symptoms if the FB is below the surface of the conjunctival epithelium. (Over a few days the epithelium may grow over small corneal FBs, with reduction in pain.) There is also generally much less pain if the object is not over the cornea but over the sclera.

**Symptoms of penetrating corneal injury**

- A corneal full-thickness injury to the cornea violates the globe of the eye. This causes a ruptured globe.
- There may be a suggestive history of sudden onset or onset after specific activity, including obvious trauma such as a road traffic accident or sports injury whilst wearing glasses, or after welding, hammering metal on metal, grinding, mowing, etc.
- Patients may be unaware of tiny FBs.
- The eye is usually painful, red and watering.

The first priority in evaluating a corneal injury is to include or exclude a full-thickness injury and therefore a ruptured globe.

NB: not all penetrating eye injuries involve corneal injury: a penetrating foreign body may also penetrate the sclera. This may be very difficult to detect and the patient may have few symptoms to suggest it.

**Arc eye symptoms**[4]

- History of UV light exposure without protective goggles - from welding, sunbed use or snow fields.
- Symptoms start 6-12 hours after exposure: a gritty sensation, pain or irritation, watering, photophobia and reduced visual acuity.

**Recurrent corneal abrasions**

- These usually occur at night when there is little secretion of tears and the epithelium may be torn off by the blinking eyelid. See the separate article Recurrent Corneal Erosion Syndrome.

**Chemical burns**[5]

Most chemicals that come into contact with the conjunctiva or cornea cause little harm. The exception is alkali-containing compounds which includes many household products. They erode and opacify the cornea, and may continue to do harm for some time after contact. Specialist review is essential but the mainstay of treatment is dilution by irrigation as soon as possible after the contact occurs.

Local anaesthetic drops may be necessary in order to allow eye opening for irrigation. After this, irrigation with sterile saline is ideal. If the chemical contains particles the lids should be spread widely, irrigation continued and a cotton bud used to lift out particles. After irrigation, acuity should be recorded and the surface of the eye stained to look for epithelial defects. It is helpful to check the pH of the tear film with litmus paper to make sure that the milieu is no long alkaline. It may take some time to wash out all alkali but if any remains damage will continue. The patient, by now probably with an anaesthetised eye, may be unaware.

**Examination**[6]

You may find the separate article Examination of the Eye helpful.
If you suspect or find signs of an open globe (penetrating) injury, stop the examination and refer immediately. DO NOT manipulate and DO NOT apply any pressure to the eye. See the separate Eye Trauma article for initial management of this injury.

Features suggesting a possible open globe injury are a history of sharp/high-velocity injury; deep eyelid laceration; distorted globe; subconjunctival haemorrhage; conjunctival laceration (may be subtle); black protruding uveal tissue; distorted iris or pupil, teardrop-shaped pupil; hyphaema.

Examination will be dictated by the patient's ability to co-operate - level of consciousness, pain, intoxication, age. Children as young as 3 or 4 can manage a slit lamp in the right conditions. It will also be dictated by your experience.

Your examination must be complete - assume the worst until you have ruled it out. Note that the degree of pain or visual impairment in ocular trauma does not necessarily correlate with the seriousness of the injury.\[7\]

Start with visual acuities of both eyes: these must always be documented in the case of corneal injury\[8\].

The patient can often give an indication of whether the current acuity seems about right for them or not. Preferably use a Snellen chart; if this is not possible, document what the patient can see - eg, signs in the waiting room, finger counting, and light perception (if the eye cannot be opened, check light perception through closed lids). Document what you find: this is invaluable when assessing how things are evolving.

Examine the eye from front to back, doing as much as your equipment allows (you may need a drop of local anaesthetic if the patient cannot open their eyes due to pain):

- Orbits and lids. Look for lacerations, subcutaneous emphysema, bruising, deformity of the orbital rim, oedema. If you think there may be a fracture, measure the medial intercanthal distance (this should be 35-40 mm in adults). Consider whether the bilateral bruising might actually be due to a base of skull fracture rather than an eye injury. (Also, conversely, rule out eye injury in the patient with 'panda eyes' from a base of skull fracture). Evert the lids.
- Conjunctiva. Look for haemorrhage and lacerations (small lacerations can be subtle - they may show up on staining with fluorescein) - these can indicate an open globe injury. Document size, shape and position of any defect.
- Cornea. Lacerations may be small and missed. First, perform a Seidel's test - outlined below - (to assess for leakage from the cornea). Then, assess for corneal abrasion with dilute fluorescein.
- Look for corneal and conjunctival FBs. The lower and upper lids need to be everted to look for FBs, particularly if there is the ongoing sensation of the presence of an FB (but do not manipulate lacerated lids).
- Anterior chamber. Look for hyphaema (seen as a fluid level of blood in an upright patient). Look for signs of injury beyond the cornea.
- Iris and pupils. Check the shape and size, and whether reactive and equal. Any pupil or iris damage is a serious sign.
- Fundus. A loss of red reflex could be due to opacification from blood in the vitreous or a large retinal detachment
- If possible, examine with a slit lamp for corneal oedema, epithelial disruption, or anterior chamber penetration.
- Ideally, intraocular pressure should also be assessed unless you suspect an open globe injury.
- Look for signs of infection - purulent discharge, an opaque base of the corneal surface defect, cells or pus in the anterior chamber (will need referral).
- If you suspect that an FB may have penetrated the cornea, you may perform Seidel's test (below) first in order to confirm this (for example, if a corneal FB appears deeply embedded); if in doubt, refer.
- Do a functional examination of the eyes (ask about diplopia, which is sometimes the only symptoms before and during examination), pupil reactions and test visual fields. Test for relative afferent pupillary defect if possible.

Time may be of the essence where a peri-ocular haematoma develops. If this is severe, the window of opportunity to examine the eye may close quickly and not reopen for several days. If unable to examine fully, refer.

Seidel's test\[7\]

Requirements
• 10% fluorescein (this is dark orange - a moistened fluorescein strip will do).
• Slit lamp with cobalt blue light source or Wood's light.

**Procedure**

Apply the fluorescein to the suspicious area, asking the patient not to blink. If aqueous fluid is leaking through a corneal laceration, a stream of fluid will be seen in the pool of dye, as the aqueous dilutes it. This is a positive Seidel's test - if found, treat for open globe injury (see box under 'Examination', above).

**NB:** a negative Seidel's test (no dilution of fluorescein) does not rule out a penetrating injury, as it may occur with small or spontaneously sealing lacerations of the cornea.

**Signs**

**Abrasion**

- Conjunctival injection (redness) or ciliary injection (if there is a corneal reaction).
- Epithelial defect that stains with fluorescein.
- Linear or multiple abrasions suggest a subtarsal FB.

**Corneal foreign body**

- Visible FB (look carefully, these can be missed at the limbus).[^9]
- Rust ring, especially if a ferrous FB has been embedded for hours or days.

**Penetrating injury**

- Multiple lacerations or injuries should raise suspicions but the penetrating injury may be very small.
- The bulbar conjunctiva is injected with prominent blood vessels.
- A full-thickness injury allows escape of aqueous humour from the anterior chamber. This may flatten the cornea, allow air bubbles to firm under the cornea or allow iris protrusion through the cornea (leading to the appearance of an asymmetrical pupil).
- Positive Seidel's test.

**Arc eye[^4]**

- Lid oedema and conjunctival redness (variable).
- Diffuse corneal haze (severe cases).
- Superficial punctate keratitis: slit-lamp examination and fluorescein stain reveal superficial punctate epithelial surface irregularities, which usually cover the entire surface of the cornea.
- If the patient's eye was partially closed during the exposure, a line demarcates normal from damaged cornea.

**Differential diagnosis[^1]**

- Open globe injuries (penetrating injury) - see box under 'Examination', above; if suspected, refer to the separate article *Eye Trauma*.
- Corneal ulcer (microbial keratitis) - suspect this in contact lens users or if there is no clear history of trauma.
- Dendritic ulcer (*herpes simplex infection*).
- Acute glaucoma.
- Uveitis.
- Scleritis.
- Chlamydial conjunctivitis.
- Herpes zoster ophthalmicus.
- Orbital cellulitis.
- Other causes of red eye:
  - Conjunctivitis
  - Episcleritis
Investigations

- Investigations are not required if you can be sure that the injury is superficial.
- Plain X-rays of the orbit/face can be used to exclude known radiopaque FBs - for example, where there is a clear history of hammering on metal, with what seems to be a superficial wound of the periorbital area.
- CT scanning usually provides more accurate imaging of FBs.
- MRI scanning is contra-indicated with known or suspected metallic FBs - as the magnetic pull on metal may cause further damage.

Management

Indications for urgent referral to an ophthalmologist \[1\] \[10\]

- Chemical burns - irrigate and refer immediately.
- Any suspected penetrating globe injury (see box under 'Examination', above) - includes any intraocular FB and all high-velocity injuries.
- Signs of infection - suspected microbial keratitis (corneal ulcer).
- Difficulty in making a full assessment - eg, if there is unclear history, lids are swollen, it is a young child, or there is a reduced level of consciousness.
- Pain which is not relieved by topical local anaesthetic.
- Subconjunctival haemorrhage, if it tracks posteriorly and there is a history consistent with a possible orbital fracture.
- Corneal injury with:
  - FB which cannot be removed
  - Corneal opacities
  - Rust ring
  - Large corneal abrasions

Contact lens users:

- Extra caution is needed to exclude microbial keratitis (a corneal ulcer) which can be subtle and may be mistaken for a corneal abrasion. Some authors suggest that all contact lens wearers who have a red, sore eye with a corneal epithelial defect should be referred to an eye unit urgently \[2\]
- Other guidelines suggest treating in A&E, but with eye clinic follow-up for contact lens users \[10\]
- Refer if this is the patient's only seeing eye

Management of corneal abrasion \[1\]

- Refer large abrasions.
- Otherwise, treat in primary care or A&E with:
  - Analgesia - paracetamol or ibuprofen is first-line; consider a one-off dose of a cycloplegic (eg, cyclopentolate 0.5%) if available; explain that the eye may be uncomfortable until it heals.
- Prevent secondary infection:
  - Tetanus prophylaxis as for any superficial wound.
- Topical antibiotic for seven days:
  - Chloramphenicol first-line (ointment may be preferred, as it lubricates the cornea \[1\]).
- Fusidic acid (twice daily) as an alternative (where the patient is pregnant, where treatment four times a day is impractical (eg, children or elderly people), or where there is personal/family history of blood dyscrasias).
- Avoid use of contact lenses until the cornea has completely healed and 24 hours after topical antibiotic use. Some guidelines suggest avoiding contact lens wear for two weeks \[10\]
- Although patching the eye has traditionally been advised for corneal abrasions, a review found no evidence of benefit (large abrasions were not studied) \[11\]. Advise not to drive with an eye patch.
Follow-up

- Re-examine the eye, using fluorescein stain, after 24 hours:
  - If the corneal abrasion is reducing in size, re-examine daily to confirm the abrasion is healing. Refer urgently if the abrasion is not reducing in size or has not healed within 72 hours.
  - Refer urgently if there are any worsening symptoms - eg, increased pain or reduced visual acuity.

Removing a corneal FB[^9]

- Only remove a corneal FB if you are confident and experienced with this procedure - otherwise, refer.
- Use a topical anaesthetic (refer if the topical anaesthetic does not remove the pain - this indicates a more serious problem).
- Ensure the patient is comfortable with their head well supported (correctly positioned at the slit lamp or with the head supported - eg, on an examination couch).
- Irrigate the eye with water, or remove the FB with a cotton wool bud or a triangle of card. A wetted cotton bud is preferable to a dry one, as it is less likely to abrade the eye.
- If this is unsuccessful, and only if you are experienced, carefully lift the FB using the tip of a sterile 25-gauge needle.
- Evert the upper lid to locate and remove a subtarsal FB. This is important if there are vertical corneal scratches or a feeling that the FB is still there.

After removal, examine and treat for a corneal abrasion as above (fluorescein stain, analgesia, topical antibiotic and tetanus prophylaxis; avoid use of contact lenses until healed).

Rust rings[^6]

- These can develop within hours, from iron in a metallic FB. They are removed using a rotating sterile burr (requires a slit lamp and training in the procedure).
- Removal may be deferred for a day or so, to allow the ring to become more superficial. Antibiotic ointment may help to loosen the ring. Rings persisting for more than 72 hours should be removed.

Management of photokeratitis (arc eye) [^4]

- Local anaesthetic, if used during examination, will completely relieve pain (temporarily).
- Treat similarly to corneal abrasion (as above):
  - Oral analgesia - eg, paracetamol or ibuprofen.
  - Topical short-acting cycloplegic.
  - Topical antibiotic - eg, chloramphenicol ointment for three days.
  - Optional eye pad.
- Do not prescribe topical anaesthetic to take home (it delays healing).
- Advise that symptoms should resolve within 24-48 hours - if not, instruct the patient to seek help, and refer.

A note on patching

Traditionally, an eye with a corneal abrasion following an FB has been patched for 24 hours in order to relieve pain and protect the cornea. However, evidence suggests the patching is of no benefit, at least for simple abrasions of <10 mm² (larger abrasions were not included in this research).[^11] Many departments no longer advise patching, or suggest a short period of patching only (eg, overnight). Patched patients should not drive.

**How to patch:** prepare two sterile surgical eye pads and adhesive tape. Fold one pad in half and place it over the closed eye (it works best with the fold edge up and the curved side pointing down). Place the second pad over the first and apply the tape. A single pad will not keep the eye shut and will cause more discomfort.
Complications and prognosis

- Corneal abrasions usually heal well.
- If they are on the visual axis, there is potential loss of visual acuity due to corneal scarring.
- Recurrent corneal abrasion syndrome can occur if the corneal epithelium is disrupted.

Prevention

Use of eye protection for hazardous occupations, involving power tools, DIY and UV light exposure.

A leaflet for the public on preventing eye injuries is available. [12]

Further reading & references

- Snellen Chart; Living Well with Low Vision

1. Corneal superficial injury; NICE CKS, September 2012 (UK access only)
5. Ophthalmic Trauma: Management of Chemical Burns; American Academy of Ophthalmologists, 2014
12. Vision Safety; Canadian Ophthalmological Society

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Original Author: Dr Olivia Scott
Current Version: Dr Mary Lowth
Peer Reviewer: Dr Helen Huins

Document ID: 2163 (v24)
Last Checked: 23/01/2014
Next Review: 22/01/2019

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