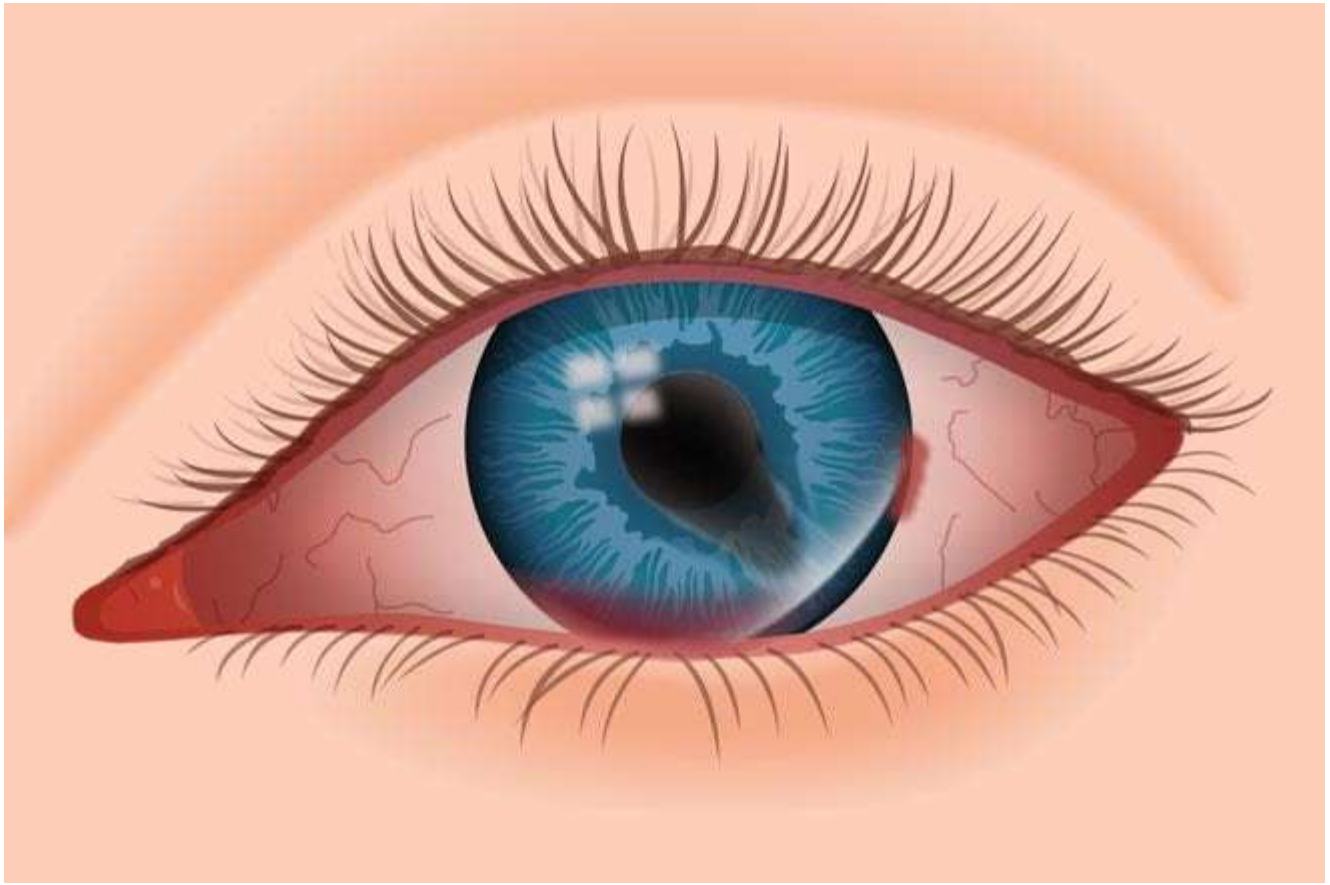
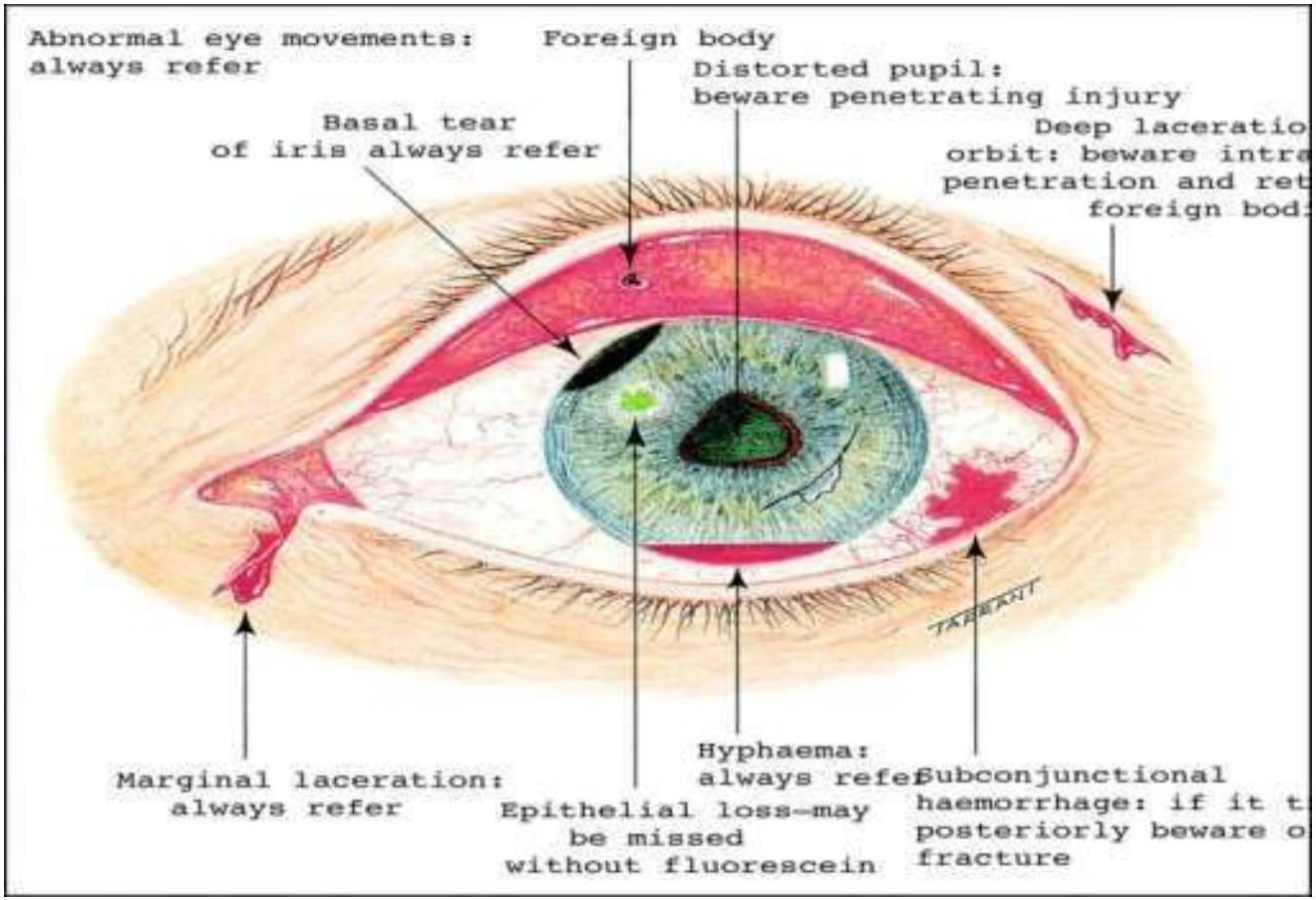
OCULAR TRAUMA

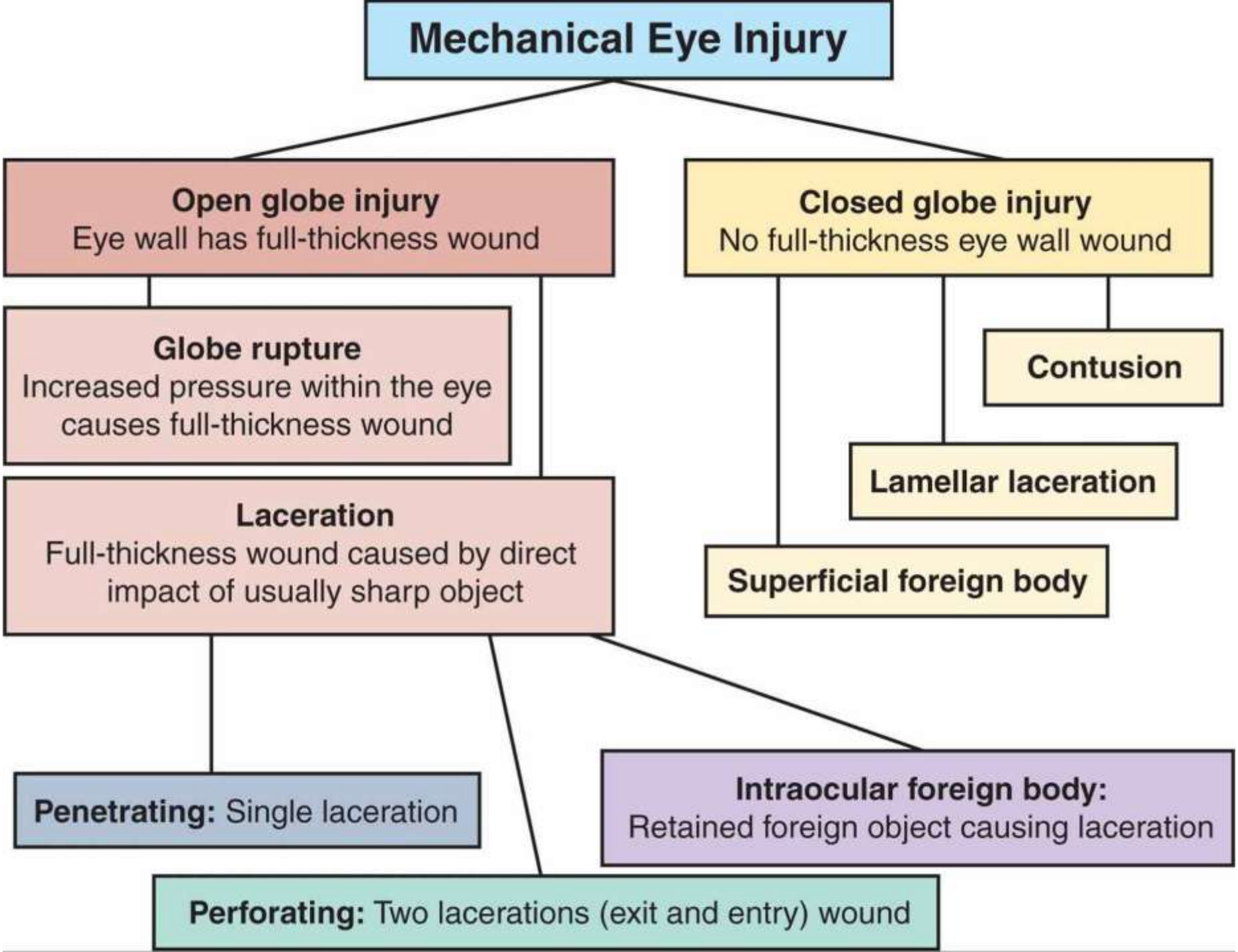


What is ocular trauma?

Damage or trauma inflicted to the eye by external means. The concept includes both surface injuries and intraocular injuries.

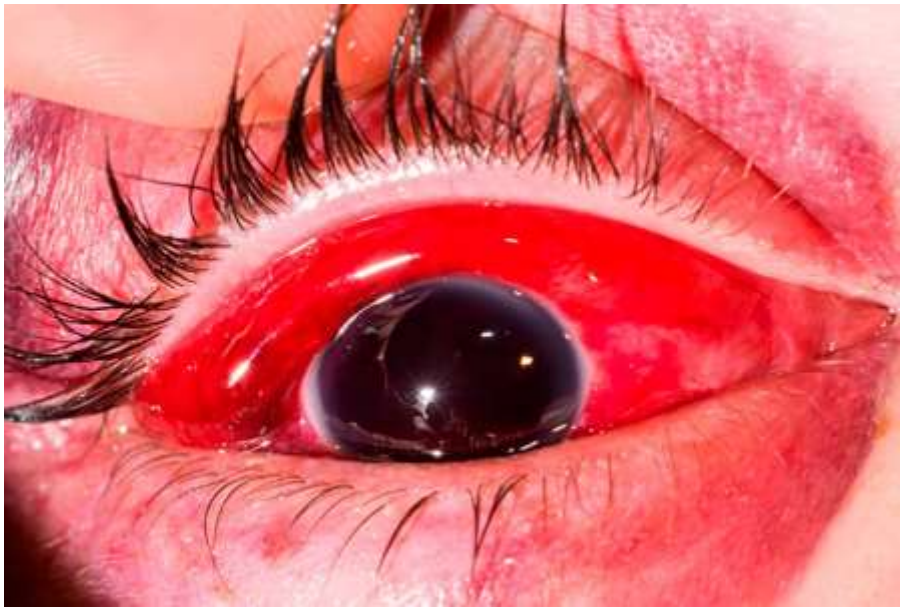
During trauma soft tissues and bony structures around the eye maybe involved.

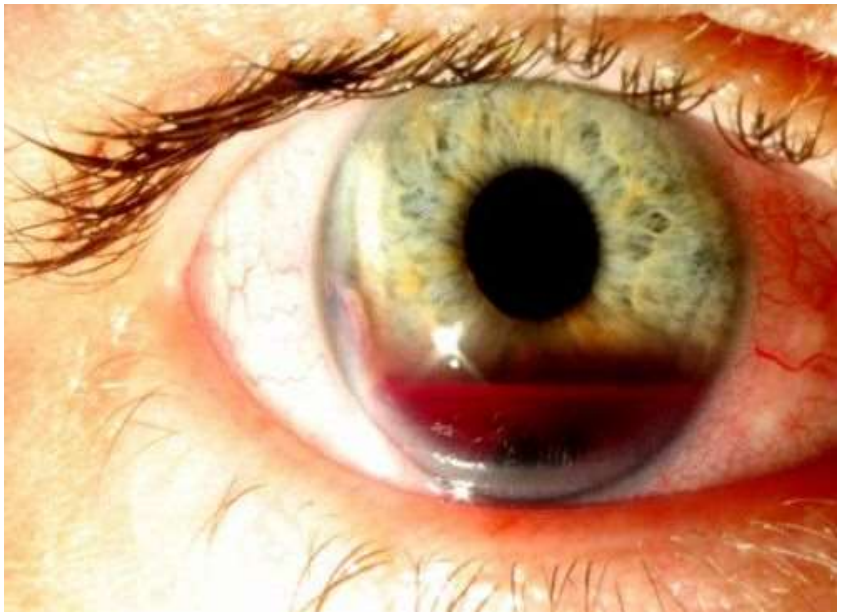



Mechanical Eye Injury
Open globe injury
Eye wall has full-thickness wound
Closed globe injury
No full-thickness eye wall wound
Globe rupture
Increased pressure within the eye causes full-thickness wound
Contusion
Lamellar laceration
Laceration
Full-thickness wound caused by direct impact of usually sharp object
Superficial foreign body
Penetrating: Single laceration
Intraocular foreign body:
Retained foreign object causing laceration
Perforating: Two lacerations (exit and entry) wound

- Ocular injuries are classified as open globe, closed globe, and periocular .
- **Open globe** — Open globe injuries have a full thickness break of the eye wall, which is composed of the sclera and the cornea.

- These injuries are further described as follows:
- ●**Open globe ruptures** – Full thickness eye injuries caused by blunt trauma
- ●**Open globe lacerations** – Full thickness eye injuries caused by sharp objects

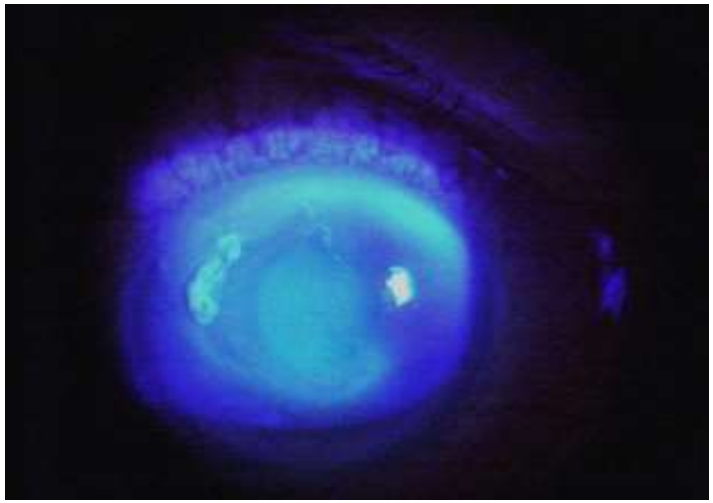




Closed globe injuries

- **Closed globe** — Closed globe injuries do not have full thickness breaks of the eye wall. They are further divided into lamellar lacerations (partial thickness wound to the eye wall) or contusions (no eye wall wound).

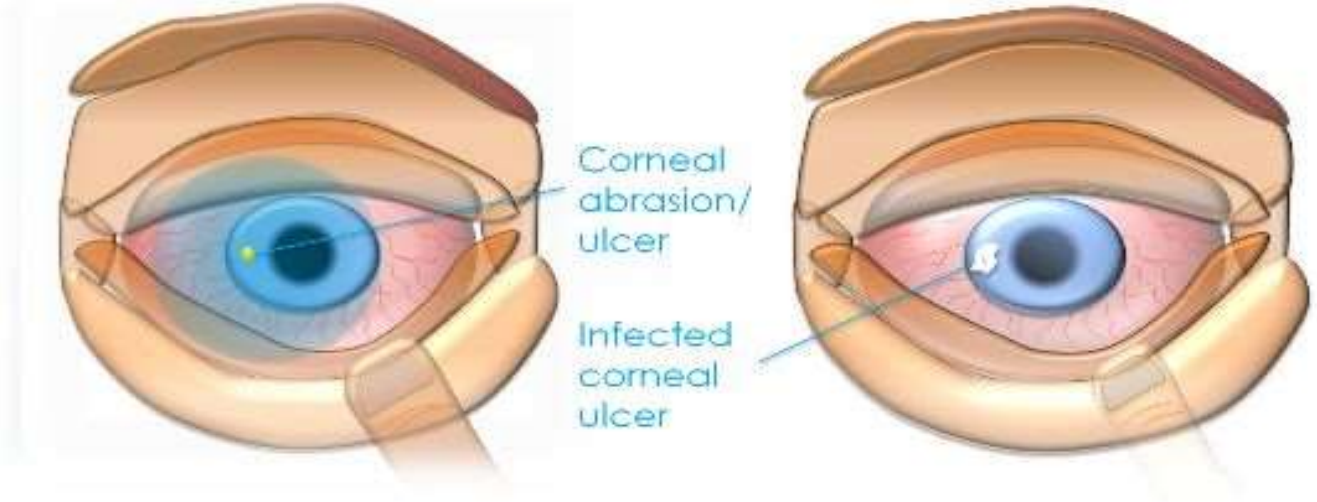
- Thus, the following injuries are also lamellar lacerations:
- ●**Conjunctival laceration** – Full thickness break of the conjunctiva
- ●**Partial thickness scleral laceration** – Incomplete scleral break **not** to the level of the choroid
- ●**Partial thickness corneal laceration** – Incomplete corneal break **without** loss of aqueous humor



- Other closed globe injuries include:
- ●**Conjunctival abrasion** – Injury to the epithelium of the conjunctiva
- ●**Corneal abrasion** – Injury to the epithelium of the cornea
- ●**Hyphema** – Blood in the anterior chamber of the eye
- ●**Traumatic iritis** – Inflammation in the anterior chamber resulting from trauma
- ●**Traumatic mydriasis** – Chronic pupil dilation usually from iris sphincter damage
- ●**Lens dislocation** – Native or artificial lens implant displacement from its original location
- ●**Vitreous hemorrhage** – Bleeding into the vitreous cavity
- ●**Commotio retinae** – Retinal whitening due to trauma-associated retinal edema
- ●**Retinal detachment** – Separation of the retina from the underlying choroid and sclera

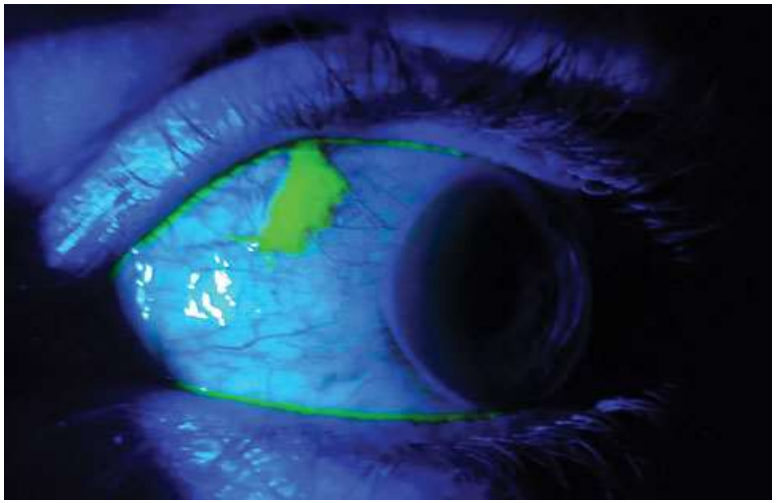
Normal eye

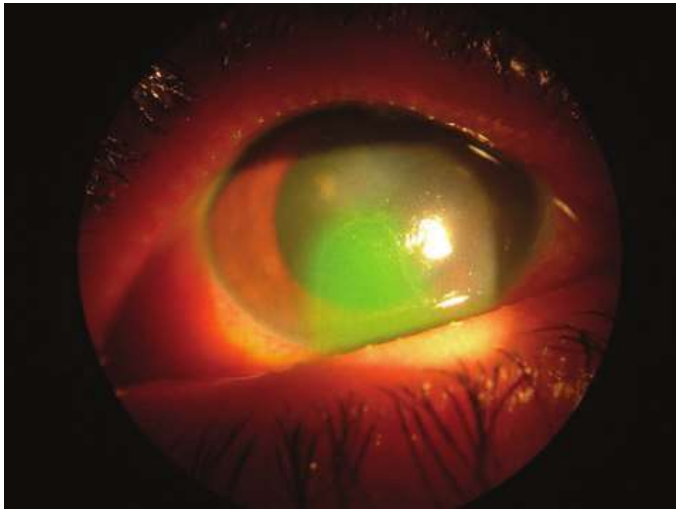
Eye with hyphaema

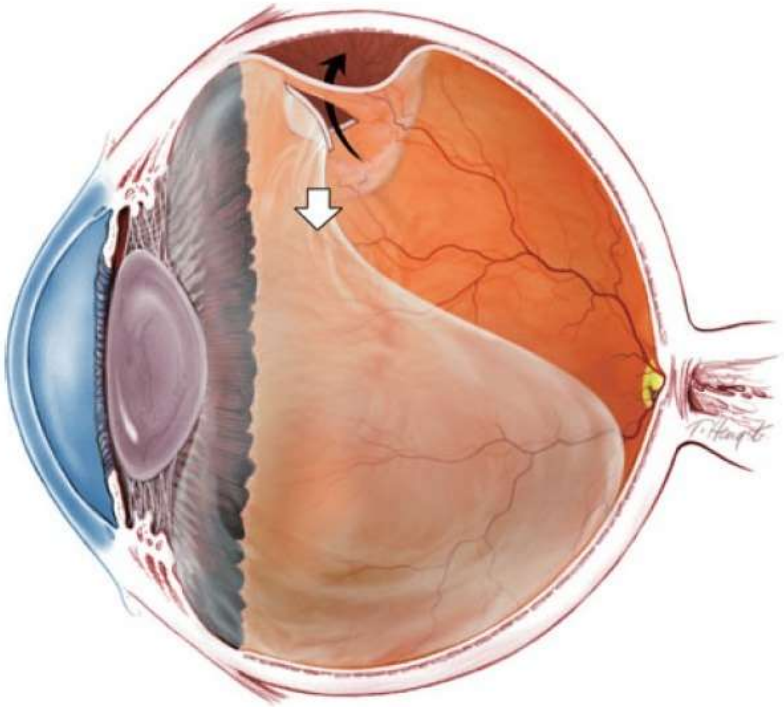


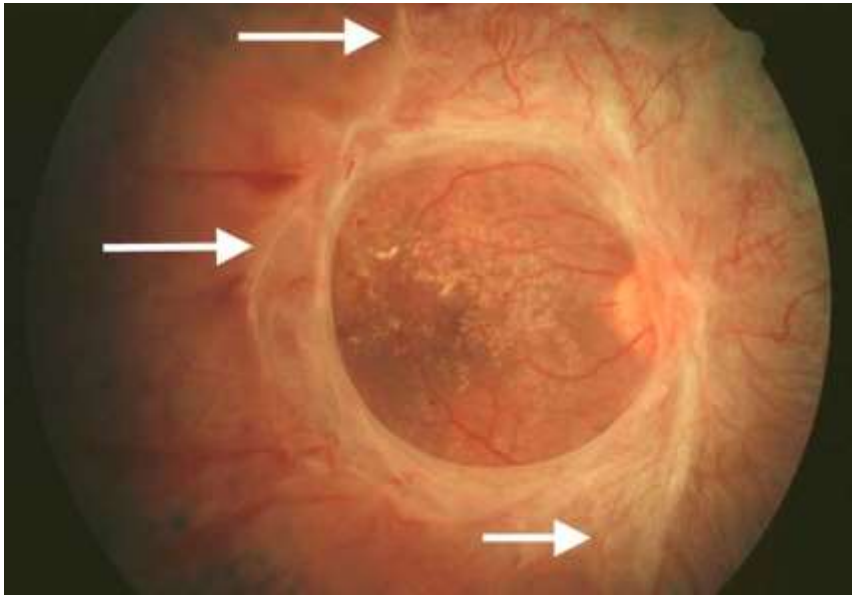
By using the slit lamp blue light and instilling fluorescein, corneal abrasions and ulcers can be easily diagnosed.

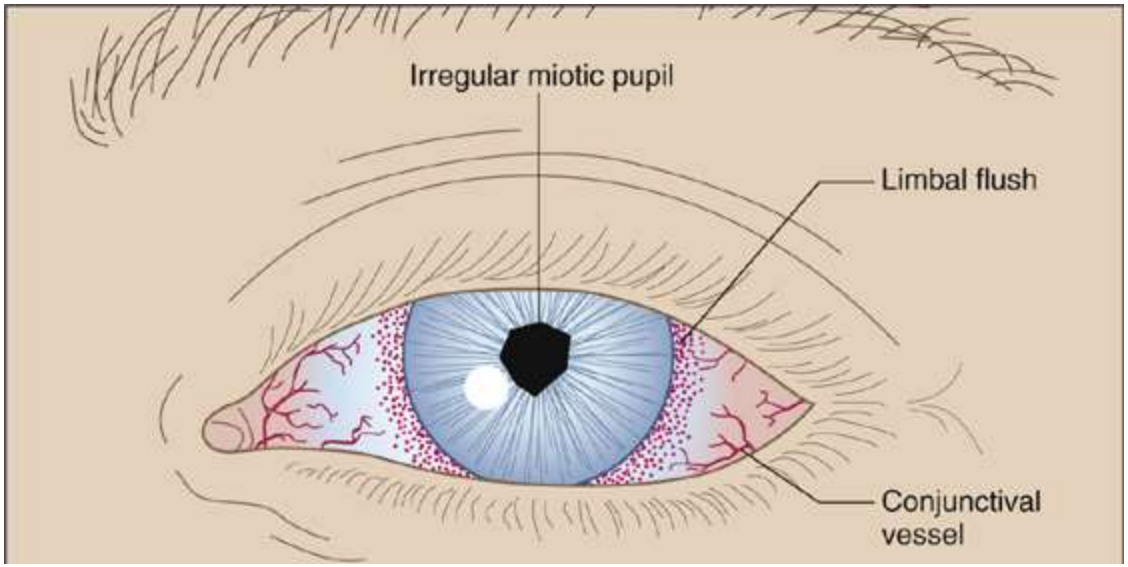
Corneal abrasions and ulcers should be treated properly. Otherwise they may become infected and cause visual impairment and severe pain. Infected corneal ulcers can lead to permanent loss of vision.

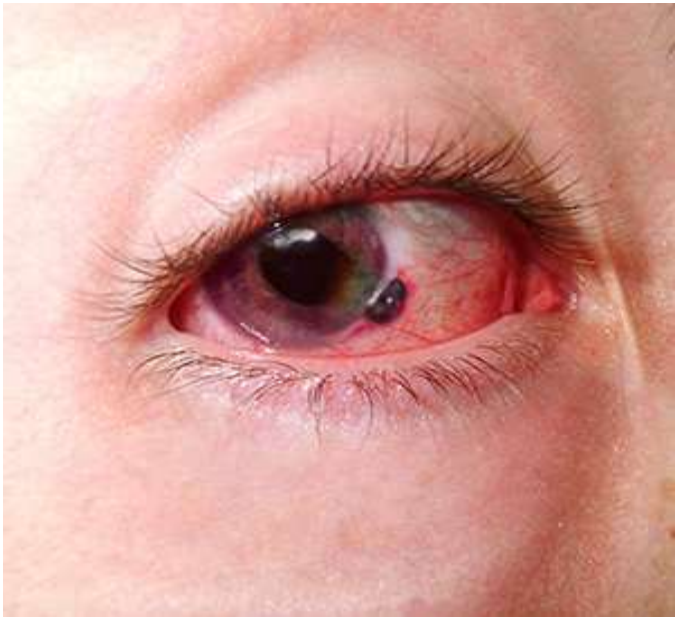









Irregular miotic pupil
Limbal flush
Conjunctival vessel

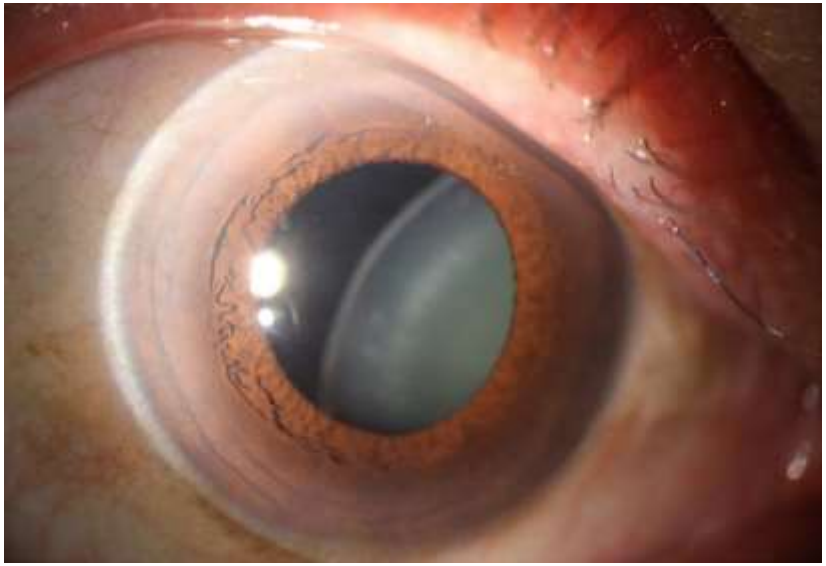


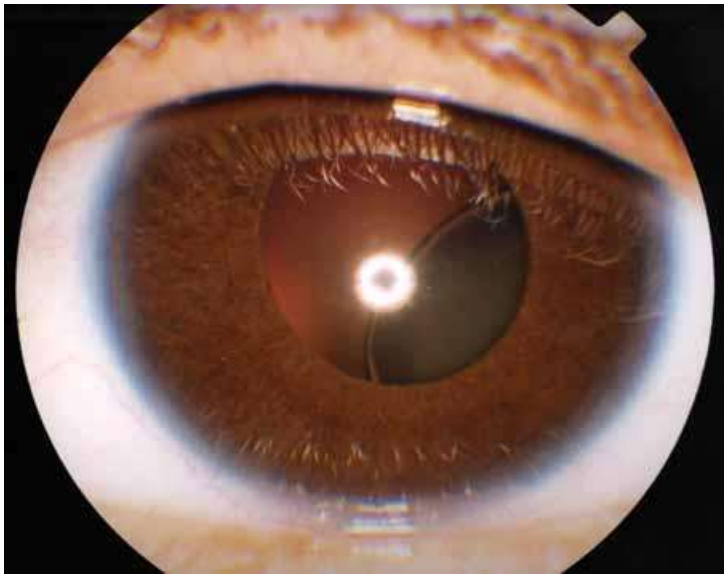
LENS DISLOCATION

subluxation of the lens

dislocation of lens
into anterior chamber of eye

dislocation of lens
into the posterior chamber of eye





Periocular injuries

- The orbital septum divides the pre-septal tissues (eyelids, meibomian glands, lashes, nasolacrimal system , and the orbicularis oculi muscle) from the deeper orbital components (orbital bones, fat, extraocular muscles, nerves, and vessels).

- Periocular injuries include:
- ●Pre-septal:
- •**Eyelid abrasions** – Superficial skin injury not requiring surgical repair
- •**Eyelid lacerations** – Full thickness skin injury usually requiring surgical repair
- •**Canalicular lacerations** – Full thickness eyelid skin injury, which includes the lacrimal drainage system; usually requires nasolacrimal cannulation for repair
- •**Periocular ecchymoses** – Skin bruising, which may indicate more serious underlying injury

Orbital :

- •**Eyelid lacerations with fat prolapse** – Full thickness eyelid skin injury with penetration through orbital septum ; requires complex repair by ophthalmology

- •**Eyelid lacerations with levator involvement** – Full thickness eyelid skin injury, which may lead to ptosis if not repaired; requires ophthalmology consultation

- •**Orbital fractures** – Fracture of any of the bones making up the socket and surrounding the eye

- •**Extraocular muscle entrapment** – Prolapse of extraocular muscle(s) into the defect created by a fractured orbital bone; may induce muscle ischemia requiring more urgent repair

- •**Orbital compartment syndrome (OCS)** – Elevated intraorbital pressure from infection, bleeding or inflammation causing poor motility and possible ocular ischemia
- •**Orbital foreign bodies** – Any post-septal foreign body present in the eye socket but outside the globe
- •**Traumatic optic neuropathy** – Acute vision loss and afferent pupil defect from trauma-induced optic nerve damage.
- •**Optic nerve avulsion** – Acute vision loss and afferent pupil defect from traumatic transection of the optic nerve
- •**Ophthalmic artery injuries** – Ocular ischemia from compression or laceration of the ophthalmic artery

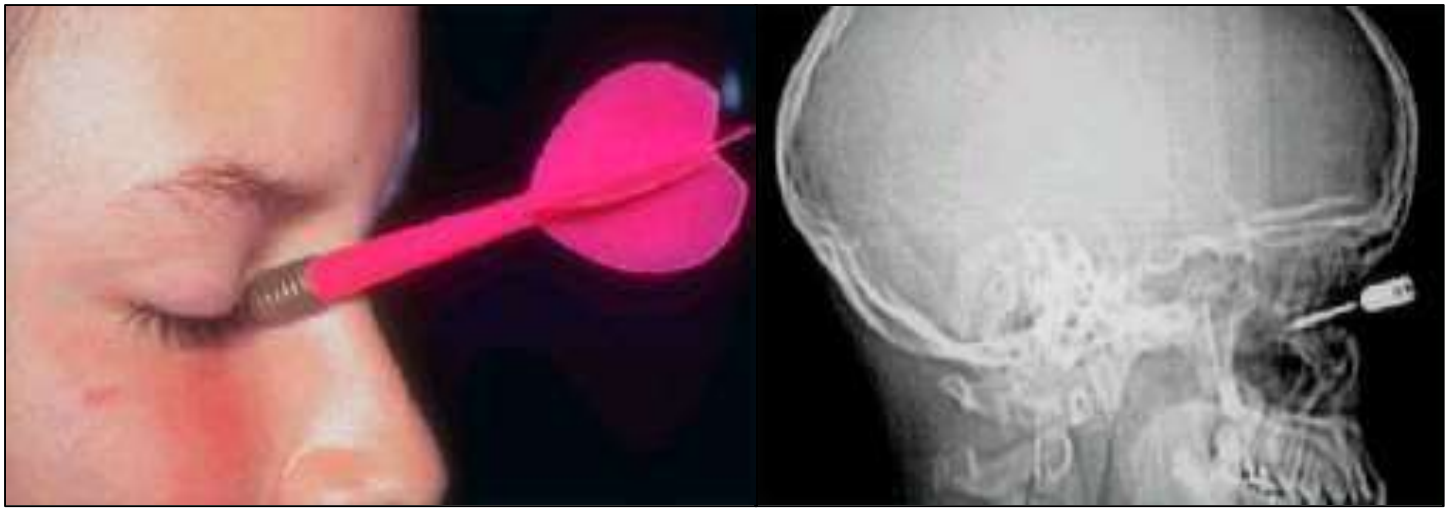


Fig. (A) Periocular haematoma and oedema; **(B)** periocular haematoma and subconjunctival haemorrhage; **(C)** ‘panda eyes’

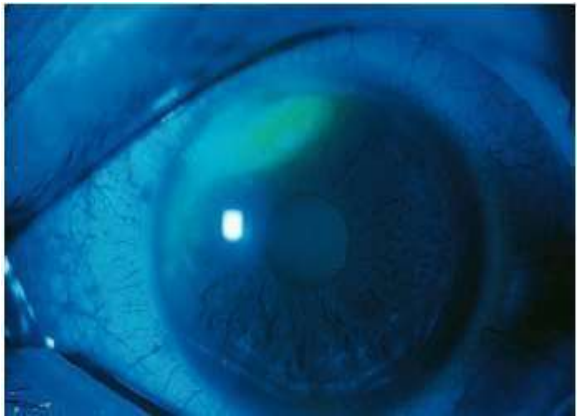
CONJUCTIVAL ABRASION

- Conjunctiva has less innervation than the cornea
- Less symptomatic than corneal abrasions.

- Foreign body sensation, mild pain, tearing, photophobia

- Conjunctival abrasion may be invisible without fluorescein staining.

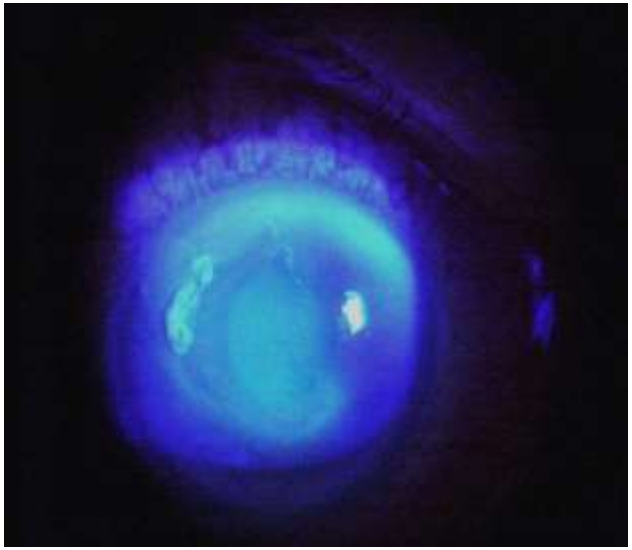
CORNEAL ABRASION



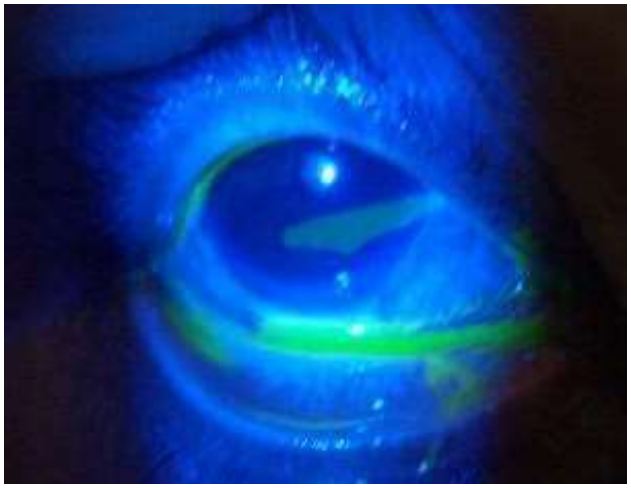
- Cornea is richly innervated → painful

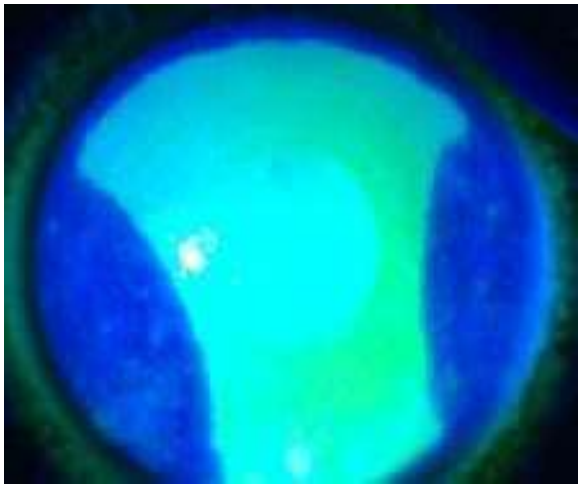
- Corneal epithelium regenerates quickly, heals within 24 to 48 hours.

Causes : Contact lens wear, fingernails makeup brushes, foreign objects blown into eyes while driving or on windy days, or which drop into the eye while working overhead (construction) or under a car (mechanics).

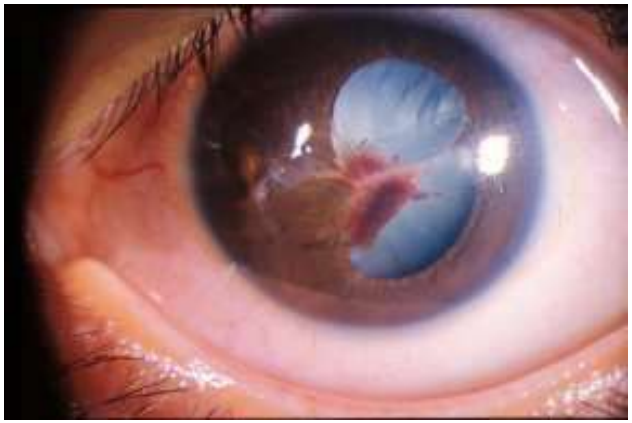


- Symptoms : Intense pain, foreign body sensation, photophobia, and tearing
- Inspection : conjunctival injection, tearing, and lid swelling
- Slit lamp : flare and cells from iritis if the abrasion is large and >24 hours old, but there is no corneal infiltrate
- The abrasion usually appears as a superficial, irregular corneal defect appearing bright green under the cobalt blue light after instillation of fluorescein





CORNEAL LACERATIONS



- Misshapen iris, macro- or microhyphema, decrease in visual acuity, and shallow anterior chamber.
- The Seidel test will be positive.
- Causes : sharp sticks, fingernails, thorns, broken glass, or sharp toys
- Pain out of proportion to physical findings, decrease in visual acuity, or other unexplained ocular symptoms.
- CT of the orbit to identify changes in globe anatomy or contour or a foreign body within the globe, and consult ophthalmology.

ULTRAVIOLET KERATITIS

Light in the UV range can cause death of corneal epithelial cells. Classically described as "*snow blindness*"

Unprotected exposure to arc welders and tanning beds, and is often called "*welder's flash.*"

Blepharospasm, conjunctival injection, and prominent tearing.

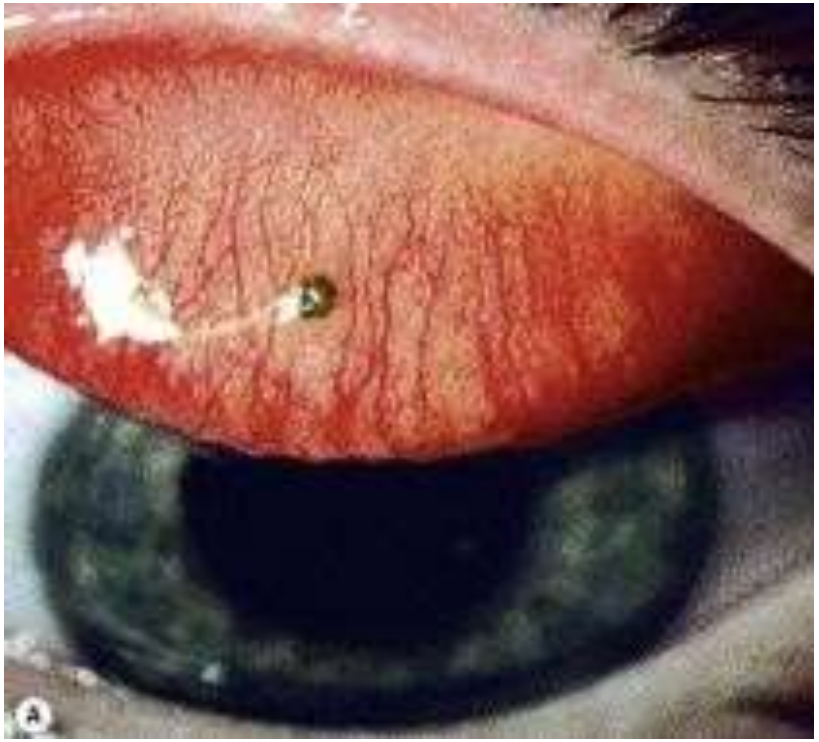
Slit lamp : diffuse punctate corneal edema, and instillation of fluorescein reveals diffuse punctate corneal abrasions.

Treatment may include double patching of both eyes if the patient requests, use of cycloplegics, topical antibiotics (erythromycin), and oral analgesics. Healing occurs in 24 to 36 hours

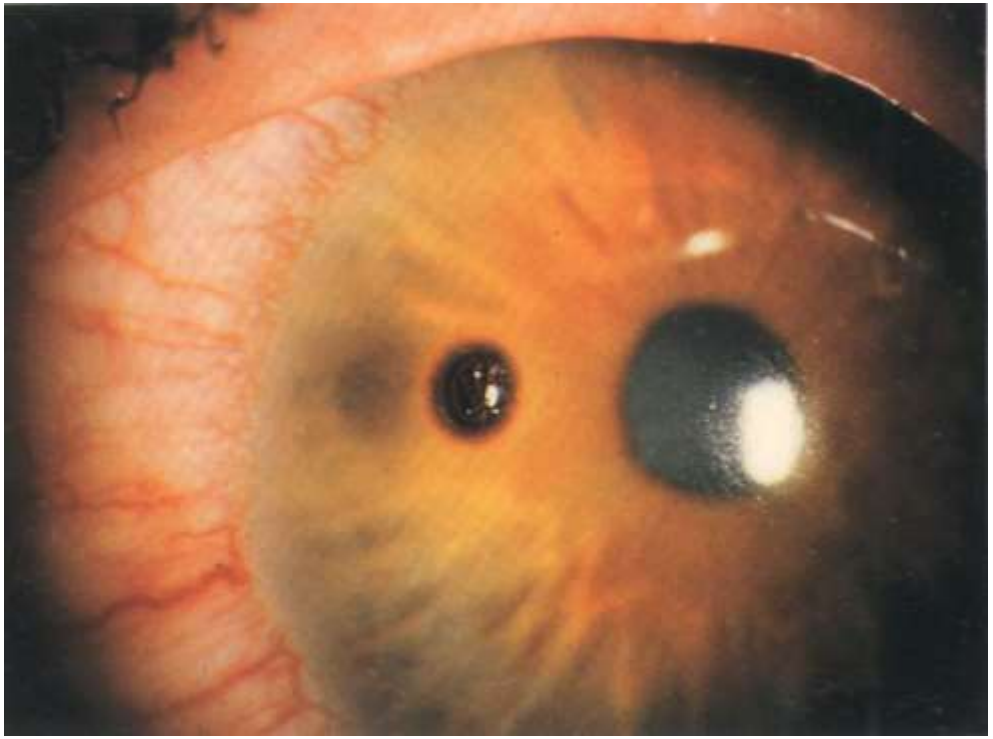
CORNEAL FOREIGN BODIES

- Penetration of a foreign body into the globe can cause loss of vision.
- Metallic foreign bodies present on the cornea for more than a few hours will cause rust to diffuse into the cornea, termed a "*rust ring.*"
- Inflammatory reaction, dilating blood vessels of the conjunctiva and causing edema of the lids, conjunctiva, and cornea
- Tearing, blurred vision, and photophobia are common
- The presence of hyphema (or microhyphema in the anterior chamber on slit lamp examination) suggests globe perforation

Superficial foreign body

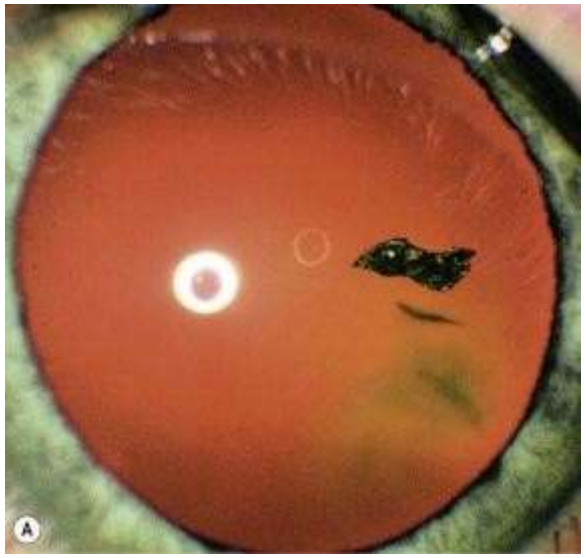


Subtarsal foreign body



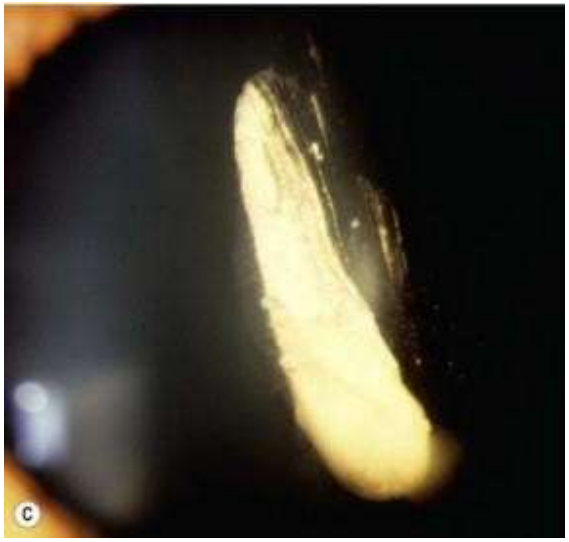
Corneal foreign body with surrounding cellular infiltration

Intraocular foreign body

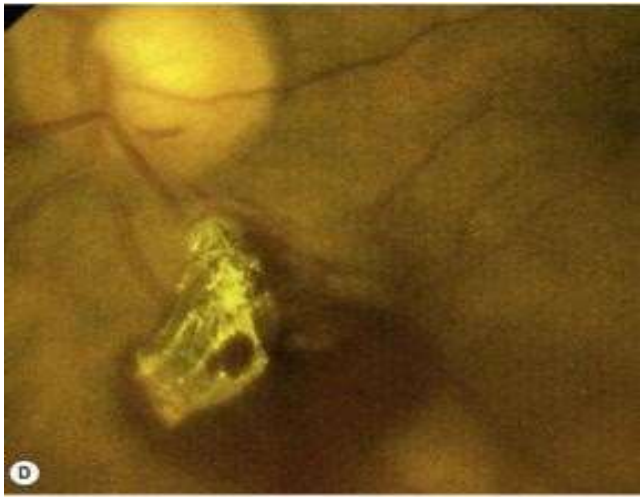


(A) In the lens

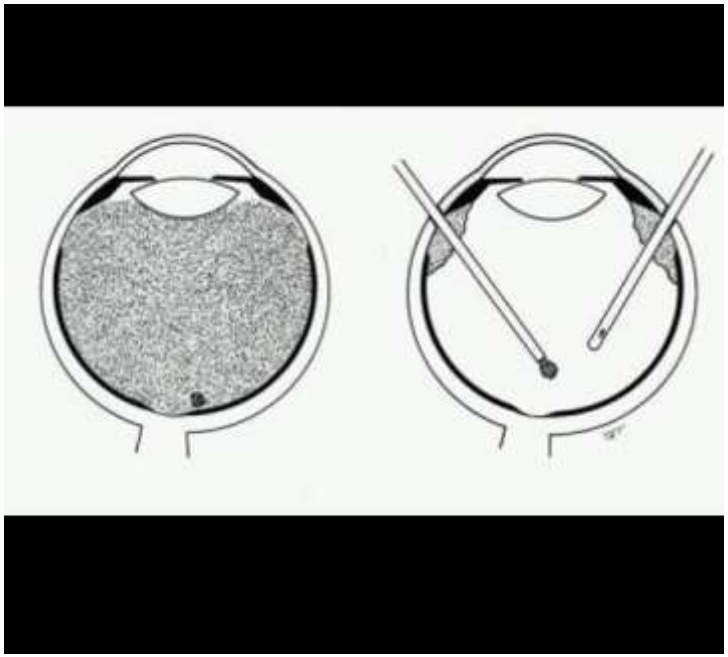
(B) In the angle

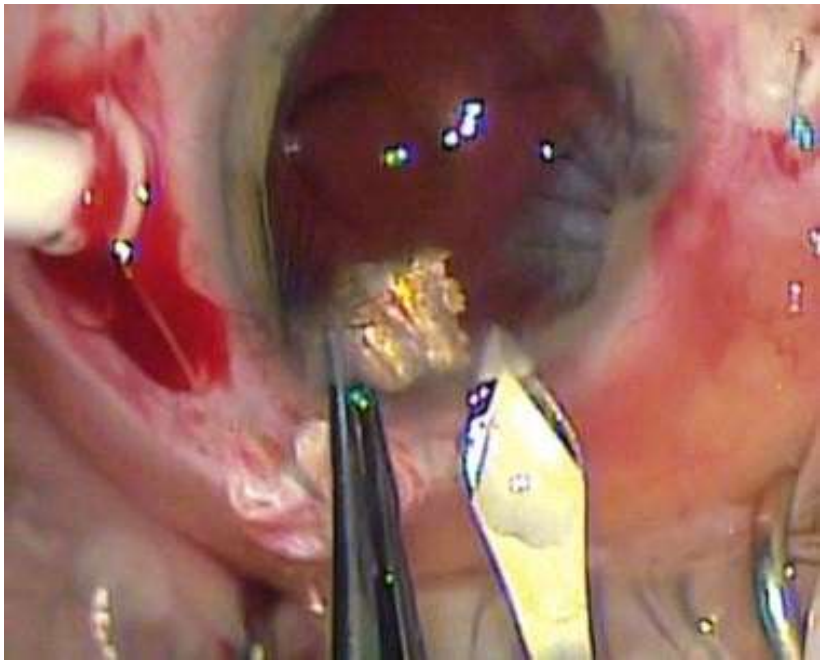


(C) in the anterior vitreous



(D) on the retina





- Removal with magnet or by pars plana vitrectomy
- with forceps either through the pars plana or limbus

LID LACERATIONS

- Eyelid lacerations that involve the lid margin
- those within 6 to 8 mm of the medial canthus
- involving the lacrimal duct or sac,
- those involving the inner surface of the lid,
- those involving the lid margins
- wounds associated with ptosis
- those involving the tarsal plate or levator palpebrae muscle **need repair by an oculoplastic specialist**.

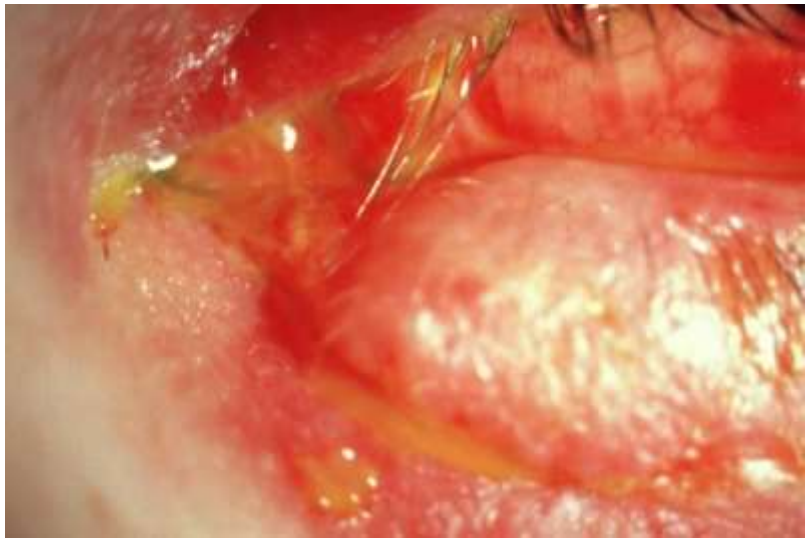


Fig. Lacerated eye injuries

General principles of repair:

1. Clean the wound
2. Remove foreign body
3. Careful handling of tissues
4. Careful alignment of anatomy
   - lid margins,lash line,skin folds, etc.
5. Close in layers
6. Timing
   - Ideally within 12-24 hours of injury but can delay up to 1 week; pt's factors, gross swelling
7. Anaesthesia – GA / LA

Repairing procedure

1. Superficial lacerations without gaping can be sutured with 5-0 / 6-0 black silk, removed after 5 days
2. Lid margin laceration

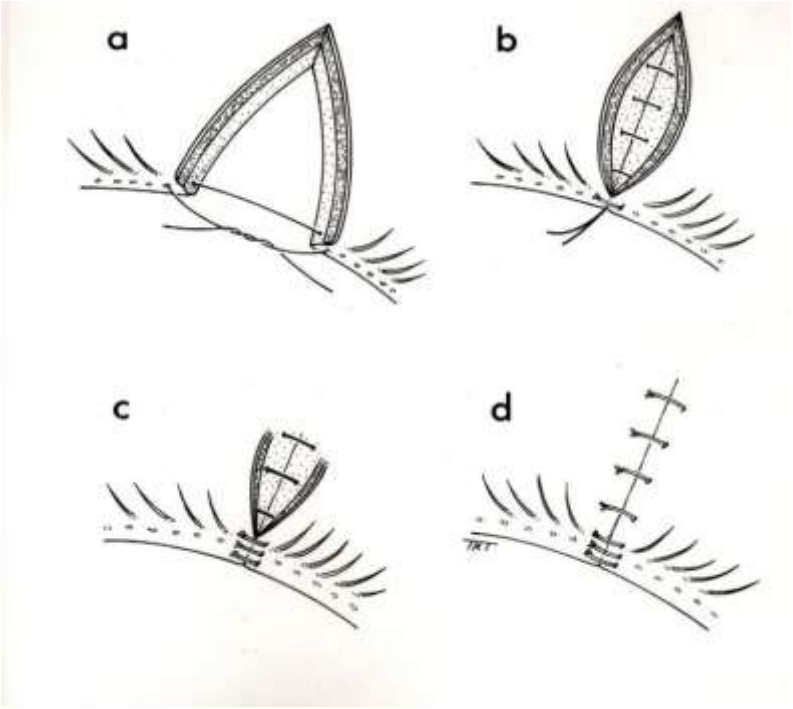
   - Carefully align to prevent notching

   a. Align with 5-0 silk suture

   b.Close tarsal plate with fine absorbable suture (5-0 vicryl)

   c. Place additional marginal silk suture

   d. Close skin with multiple interrupted suture



2. Lacerations with tissue loss

   - Primary closure and may also need a lateral cantholysis

Repairing lid margin lacerations

BLUNT EYE TRAUMA

- Assessment of the visual acuity, anterior chamber, and integrity of the globe.

- If the anterior chamber is flat, a ruptured globe is certain
- Restricted upgaze or lateral gaze suggests a blow-out fracture with entrapment and a CT scan of facial bones should be obtained.

- Feel the orbital rim above and below for step-off deformities.
- Test for cutaneous sensation along the distribution of the inferior orbital nerve (below the eye and ipsilateral side of the nose).

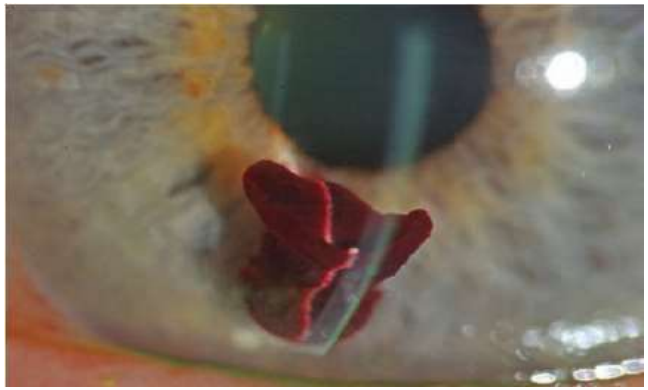
- **Perform a slit lamp examination with fluorescein staining to check for abrasions, lacerations, foreign bodies, hyphema, iritis, and lens dislocation.**

- If vision and ocular anatomy and function are preserved, outpatient follow-up by an ophthalmologist in the next 48 hours.

- If a ruptured globe is suspected due to loss of visual acuity, flat anterior chamber, obvious full-thickness laceration, or intraocular foreign body, do not manipulate the eye or measure intraocular pressure.

- Consult ophthalmology immediately.

HYPHEMA

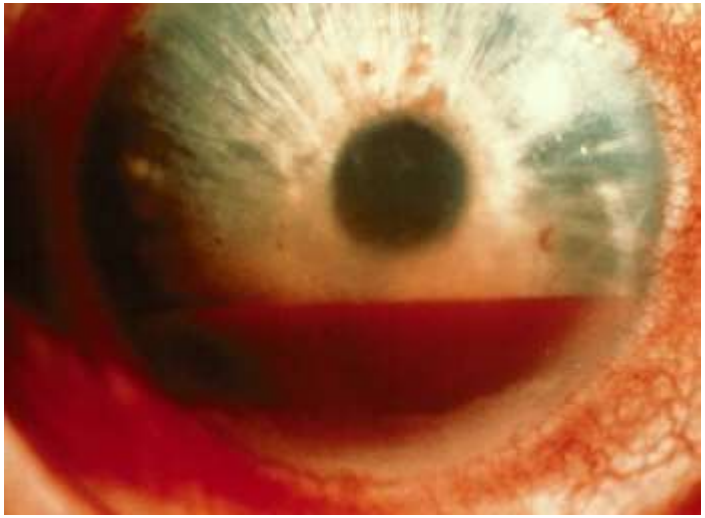


- Blood or blood clots in the anterior chamber are referred to as a *hyphema*

- Traumatic hyphema usually : bleeding from a ruptured iris root vessel.
- Spontaneous hyphemas : sickle cell disease

- Treatment: Elevate the patient's head to promote settling of suspended RBCs inferiorly to prevent occlusion of the trabecular meshwork.

- After consultation with the ophthalmologist, dilate the pupil to avoid "pupillary play" (constriction and dilation movements of the iris in response to changing lighting conditions), which can stretch the involved iris vessel, causing additional bleeding



- Control of intraocular pressure consists of topical β-blockers, IV mannitol, topical α-adrenergic agonists (apraclonidine), and oral, topical, or IV carbonic anhydrase inhibitors (CAIs) such as Diamox.

- **Do not give CAIs to patients with sickle cell disease.**

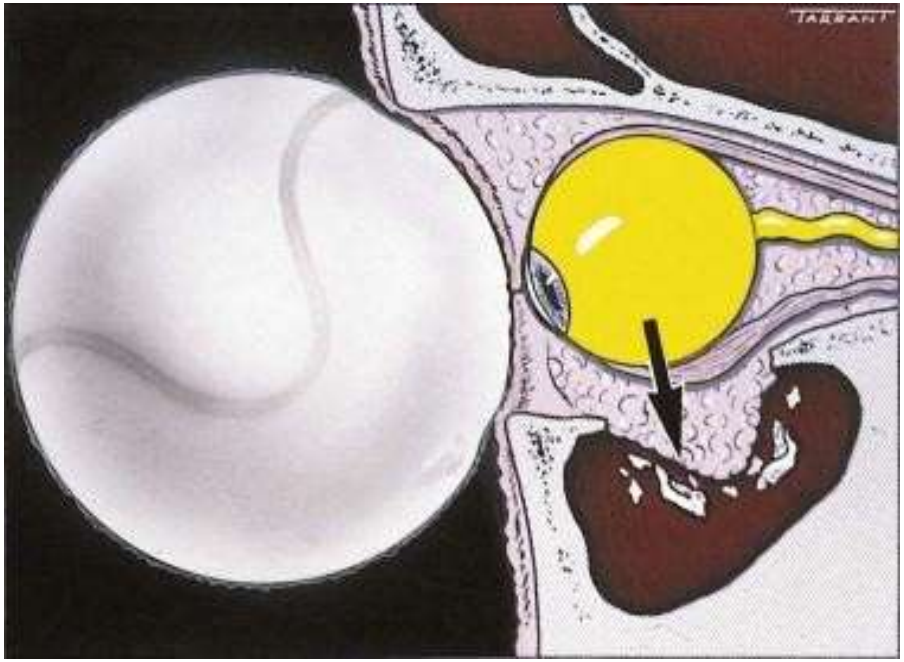
- patients with hyphemas occupying one third or less of the anterior chamber can be followed closely as outpatients

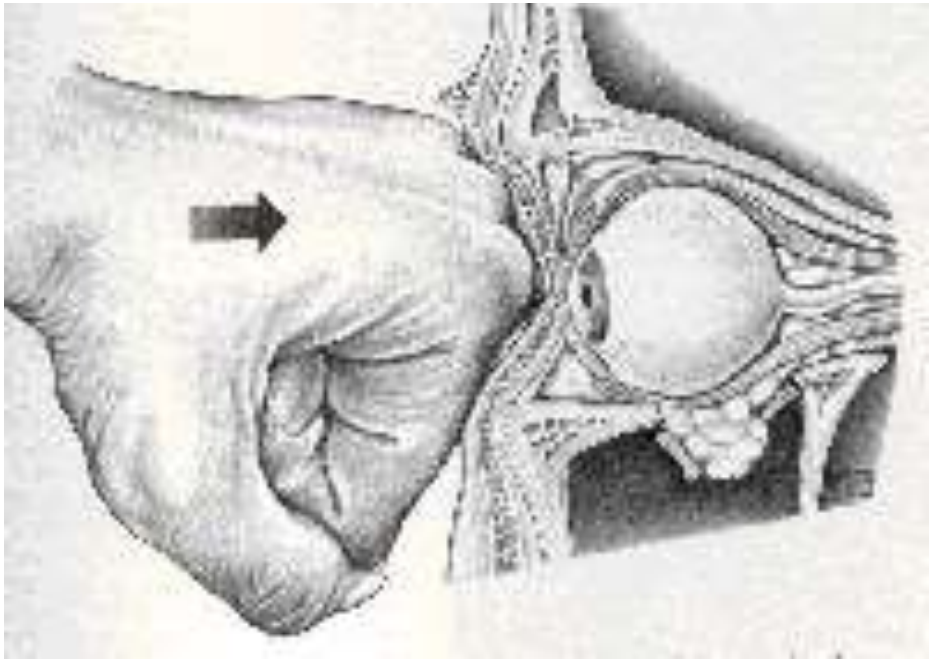
BLOW-OUT FRACTURES

- Most frequent sites : inferior wall (maxillary sinus) and medial wall (ethmoid sinus through the lamina papyracea).

- Fractures of the inferior wall with entrapment of the inferior rectus muscle can cause restriction of upgaze and diplopia

Mechanism of an orbital floor blow-out fracture

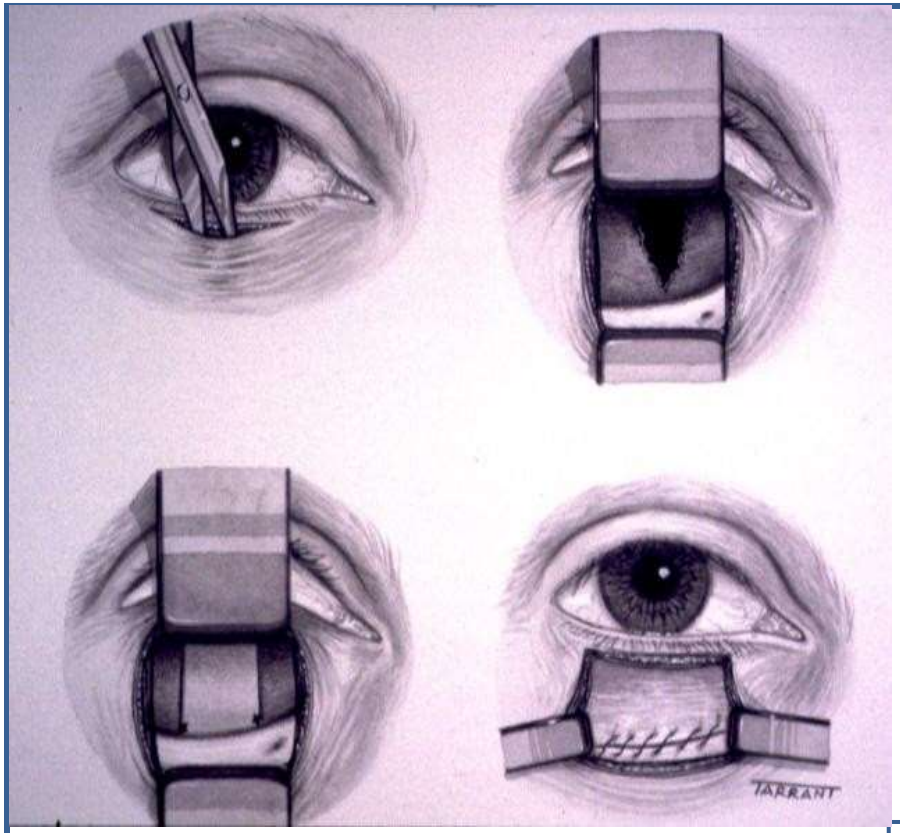




Signs of orbital floor blow-out fracture

- Periorbital ecchymosis, oedema and emphysema may also present
- Infraorbital nerve anaesthesia
- Ophthalmoplegia tipically in up and down-gaze (double diplopia)
- Enophthalmos – if severe

Surgical repair of orbital floor blow-out fracture



a. Subciliary incision

b.Periosteum elevated and entrapped orbital contents freed

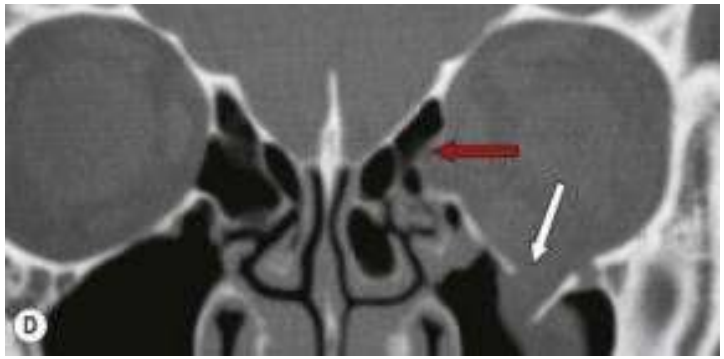
c.Defect repaired with syntheticmaterial

d. Periosteum sutured

- Coronal CT scan following repair of right blow-out fracture with synthetic material

Medial wall blow-out fracture

Signs & Investigation



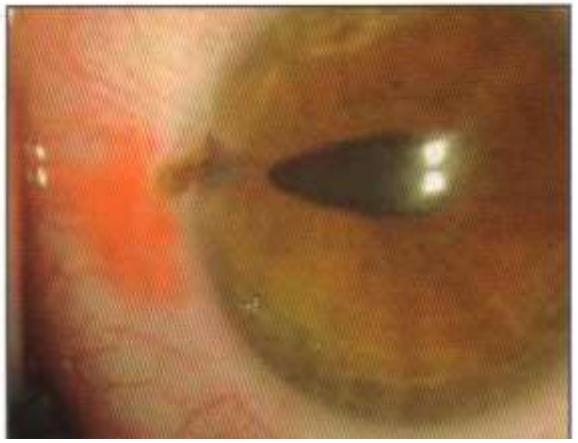
- Periorbital subcutaneous emphysema
- Ophthalmoplegia - adduction and abduction if medial rectus muscle is entrapped

- CT coronal view shows fractures of the medial wall (red arrow)

Treatment

- Release of entrapped tissue
- Repair of bony defect

RUPTURED GLOBE

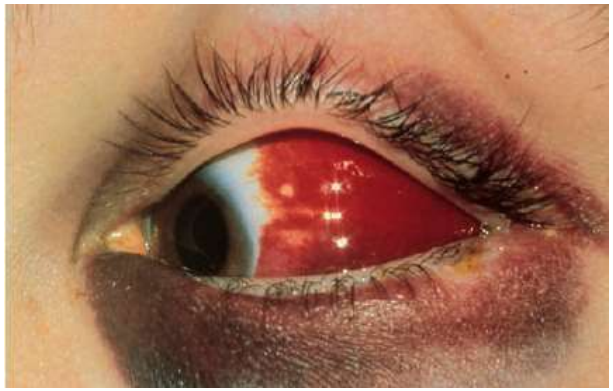


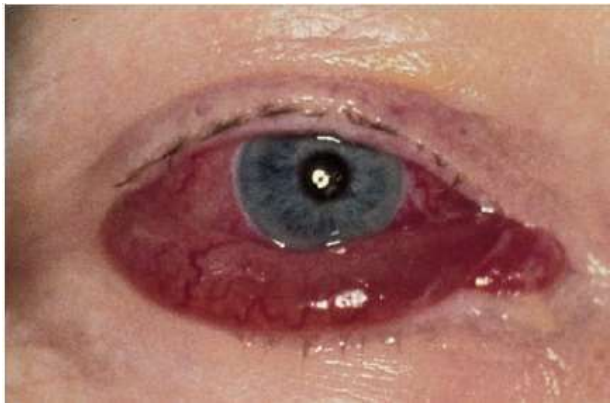
- Mechanism of Injury Scleral rupture may occur from blunt or penetrating trauma

- Penetrating trauma may occur from bullets, BB pellets, knives, sticks, darts, needles, hammering, and lawn mower projectiles.

- Suspect globe penetration with any puncture or laceration of the eyelid or periorbital area.

- Corneal abrasions occurring when hammering metal on metal, associated with use of high-speed machinery such as lawn mowers, line trimmers (weed whackers), grinders, or drills, and sustained during explosions should always be investigated for occult globe penetration.





- Whenever globe rupture is suspected, cover the eye with a metal eye shield **and consult ophthalmology immediately**

- Clinical features : Decreased visual acuity, an irregular or teardrop-shaped pupil, an afferent pupillary defect, shallow anterior chamber, hyphema, positive Seidel test, and lens dislocation

- **Presence of a large subconjunctival hemorrhage involving the** entire sclera or hemorrhagic chemosis (bullous, raised subconjunctival hemorrhage) is very suspicious for rupture of the globe .

- Uveal prolapse through a scleral wound may appear as a brownish-black discoloration against the white sclera

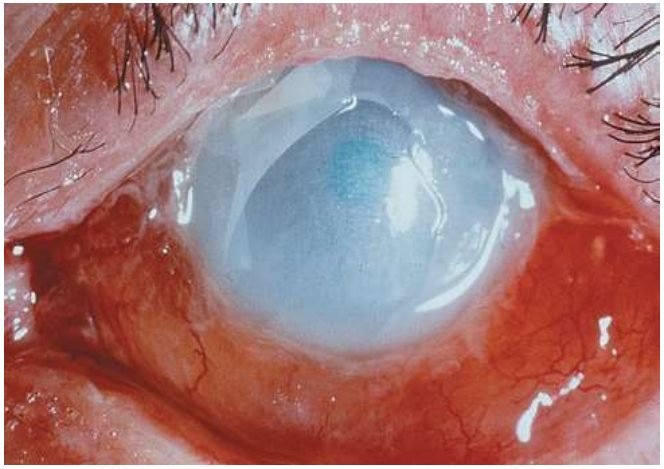
- US as well as both direct and indirect ophthalmoscopy helpful in locating orbital and intraocular foreign bodies.

- Immediate ophthalmologic consultation
- Broad-spectrum IV antibiotics and TT administered
- Provide sedation and analgesia
- Administer antiemetic agents to prevent increased IOP and extrusion of intraocular contents from vomiting or retching.
- The patient should be maintained NPO, anticipating surgery

RETROBULBAR HEMATOMA

- Severe blunt trauma to the orbit can occasionally cause a retrobulbar hematoma.
- Abrupt increase in IOP cause decreased blood flow to the optic nerve and loss of vision.
- Pain, proptosis, and decreasing vision.
- A CT scan of the orbit will demonstrate retrobulbar hemorrhage.
- An intraocular pressure >40 mm Hg is a consideration for emergency canthotomy.

CHEMICAL OCULAR INJURY



- Complications of chemical burns to the eye include scarring of the cornea with permanent loss of vision and loss of the eye due to corneal perforation.

- Irrigation of the eyes with 1 to 2 L of NS must be done immediately and before any examination, including testing of vision.

Grading of severity of chemical injuries

Grade I (excellent prognosis)

- Clear cornea
- Limbal ischaemia - nil

Grade II (good prognosis)

- Cornea hazy but visible iris details
- Limbal ischaemia <1/3

Grade III (guarded prognosis)

- Hazy cornea with no iris details
- Limbal ischaemia 1/3 to 1/2

Grade IV (very poor prognosis)

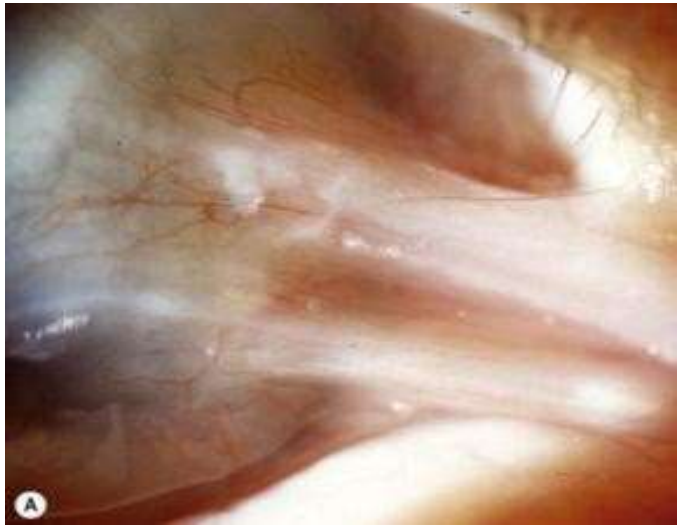
- Opaque cornea
- Limbal ischaemia >1/2

- G - II

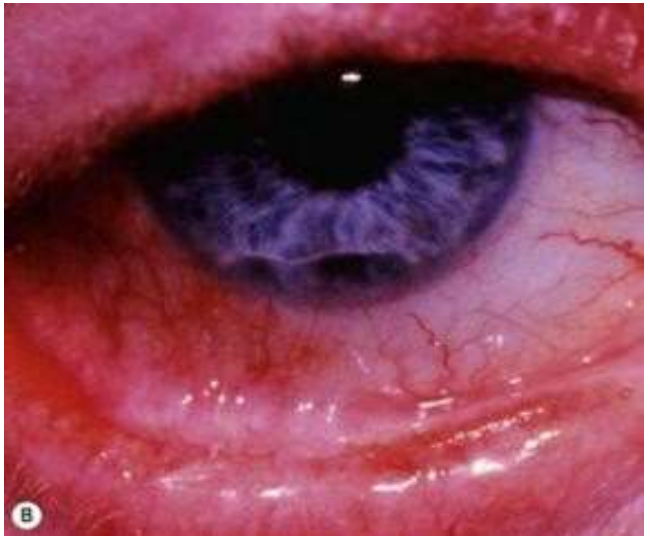
- G - III

- G - IV

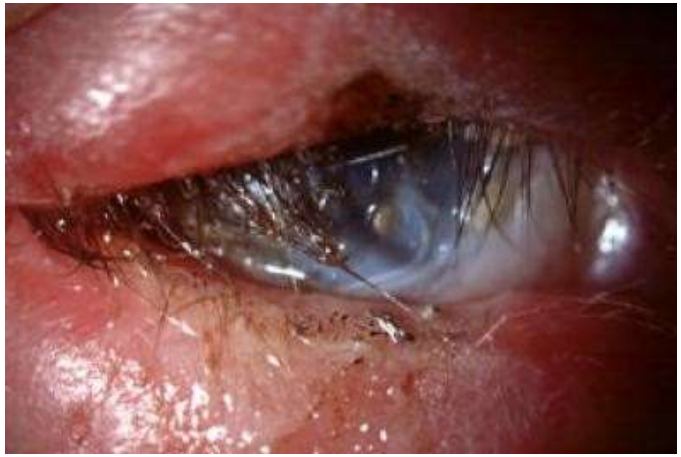
Surgical Management of Severe Chemical Injuries



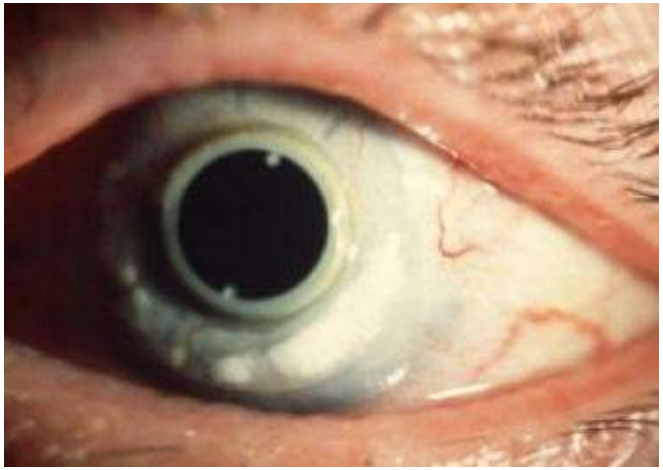
Division of conjunctival bands



Re-establish the fornices



Correction of eyelid deformity



Treatment of severe corneal opacity by keratoplasty or keratoprosthesis