

EYE INJURIES

Open globe laceration with a teardrop pupil



The first step in eye injuries is CT scan to rule out life-threatening injuries

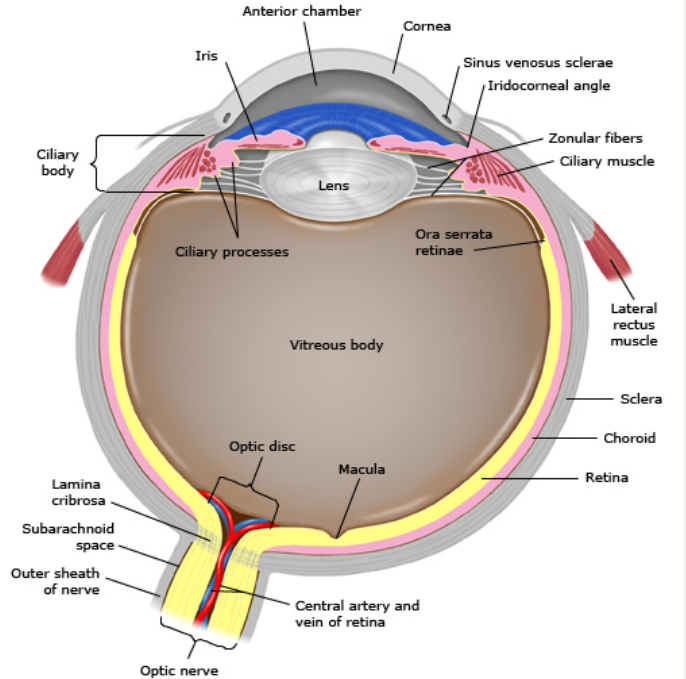
Dr Mouna Al Saad

Introduction

- The eyes are well protected, yet they are subject to injury.
- Eyes are located near vital regions such as the intracranial space, the cervical spine, and the airway.
- Life-threatening injuries need to be considered first.
- Eye injury includes trauma to the eye (ocular trauma), the orbit (periocular trauma), or both.
- Threats to vision need to be identified using a focused history and P/E.

Anatomy

- The eye is composed of three layers:
 - The external fibrous layer or outer wall (cornea and sclera)
 - The middle vascular layer (choroid, ciliary body, and iris)
 - The internal layer (retina)



Common eye injuries

- Eyelid lacerations
- Corneal abrasions and corneal foreign bodies
- Conjunctival injuries.
- Orbital fractures

Eyelid lacerations

- Ocular injury may accompany eyelid laceration in up to two-thirds of cases.
- **Types of eyelid lacerations:**
 - Full-thickness laceration of the eyelid
 - Lacerations with orbital fat prolapse
 - Lacerations through the lid margin
 - Lacerations involving the tear drainage system. Inner corner of the eye (towards the nose)
 - Lacerations with poor alignment and/or avulsion



Laceration with orbital fat prolapse

** Laceration through the lid margin (+ involves the tear drainage system as well)

** In this case as shown the injury might be an isolated injury to the eyelid but might as well involve the eye itself



Corneal abrasions and corneal foreign bodies

Might be accompanied by *Pseudomonas aeruginosa* infection >> ciprofloxacin

- **Corneal abrasion:**
- Loss of the epithelial layer
 - Severe eye pain Exposed nerve endings
 - Reluctance to open the eye due to photophobia
 - Foreign body sensation.
- ② Normal visual acuity
 - Normal pupillary response
 - Staining defect on fluorescein examination



Unless the abrasion involves the center of the cornea then vision might be affected

Corneal foreign bodies



Easily removed on a slit lamp with the aid of a needle

Vision-threatening conditions

- Ocular chemical burns
- Orbital compartment syndrome
- Open globe injury
- Traumatic hyphema
- Vitreous haemorrhage
- Retinal trauma
- Optic nerve injury
- Periocular injuries that threaten vision

Ocular chemical burns

- Eye contact with acids or alkalis.
- Emergent evaluation and treatment to prevent permanent vision loss.
- Alkaline substances usually cause more severe damage than acids.

** We irrigate the other eye as well because of its proximity to the injured eye and to the source of the chemical meaning it must've been affected in a way or another

Patients present with:

Decreased vision

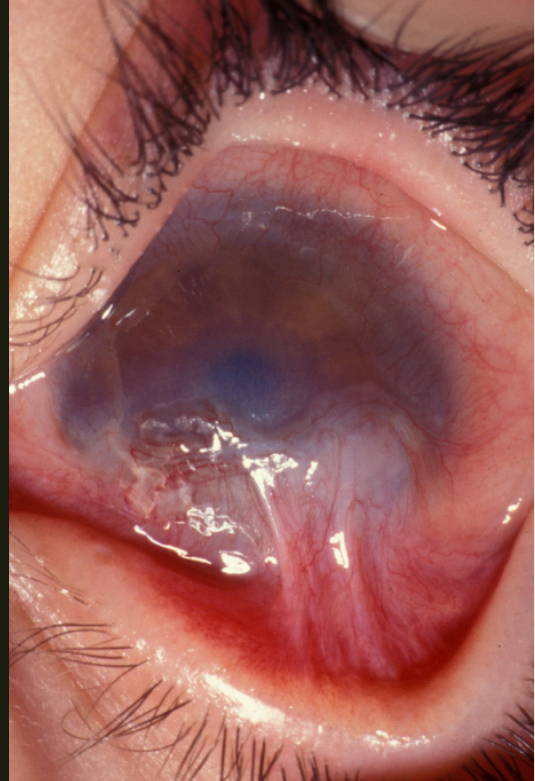
Moderate to severe eye pain,

Blepharospasm (inability to open the eyelids),

Syblepharon (lid attached to globe) Late complication

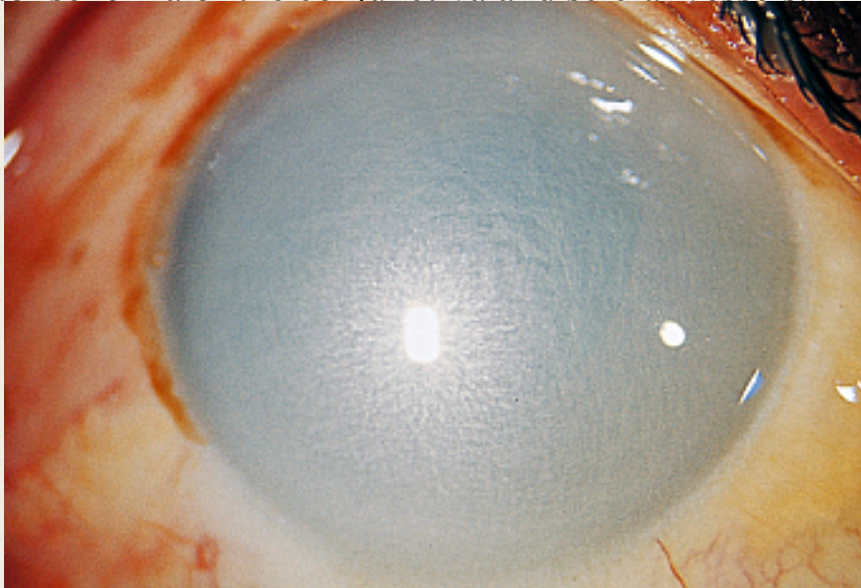
Conjunctival redness.

Photophobia



- In severe cases of alkali exposure, the eye may appear white.
- Due to ischemia of the conjunctiva and scleral vessels.

What to do in this case ?
Stem cells get harvested from the healthy eye and transplanted on the surface of the injured eye
Following ~ 6 months we do corneal transplantation
(The patient won't regain his 6/6 vision but there will be decent improvement)



** Limbal stem cells irradiation
** Injured nutrient corneal blood vessels

Management

Immediately (starting at home)

- Continuous irrigation with water or saline is recommended.
- Neutral pH in the eye must be achieved, usually takes 30 to 60 minutes.
- Morgan lens can be used.
- Irrigation should be less forceful if a concomitant globe rupture is suspected. Not to increase the eye pressure and worsen the case

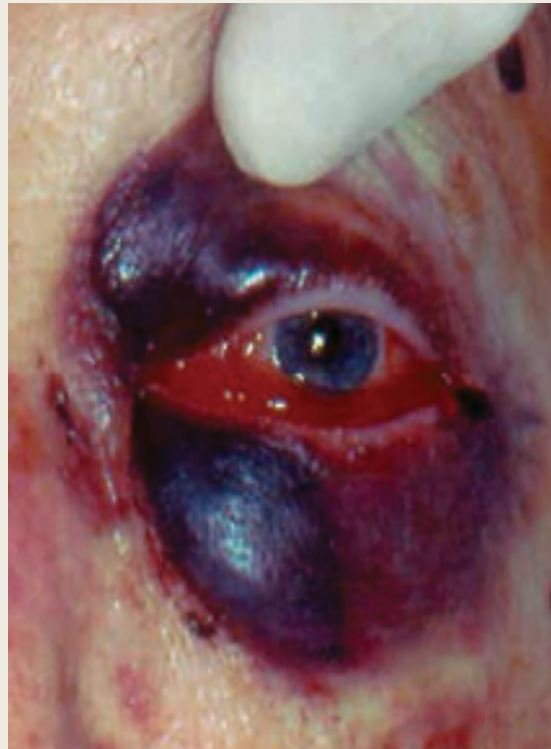


Orbital compartment syndrome

- True ophthalmologic emergency, requiring immediate intervention
- The orbit is a confined space with its surrounding bony walls
- Trauma and intraorbital hemorrhage cause rapidly elevated intraorbital pressure.
- Pressure is transmitted to the eye and optic nerve causing ischemia and an orbital compartment syndrome (OCS).
- It is diagnosed clinically.

Signs & Symptoms

- Acute onset of decreased vision
- Diplopia
- Eye pain
- Periorbital swelling/ hemorrhage
- Subconjunctival hemorrhage
- Chemosis
- Proptosis
- Ophthalmoplegia
- Afferent pupillary defect Means that the optic nerve is compromised (we're losing the eye)
- Tightness of the eyelids
- Decreased retro-pulsion (resistance to attempts to push the eye farther back into the orbit).

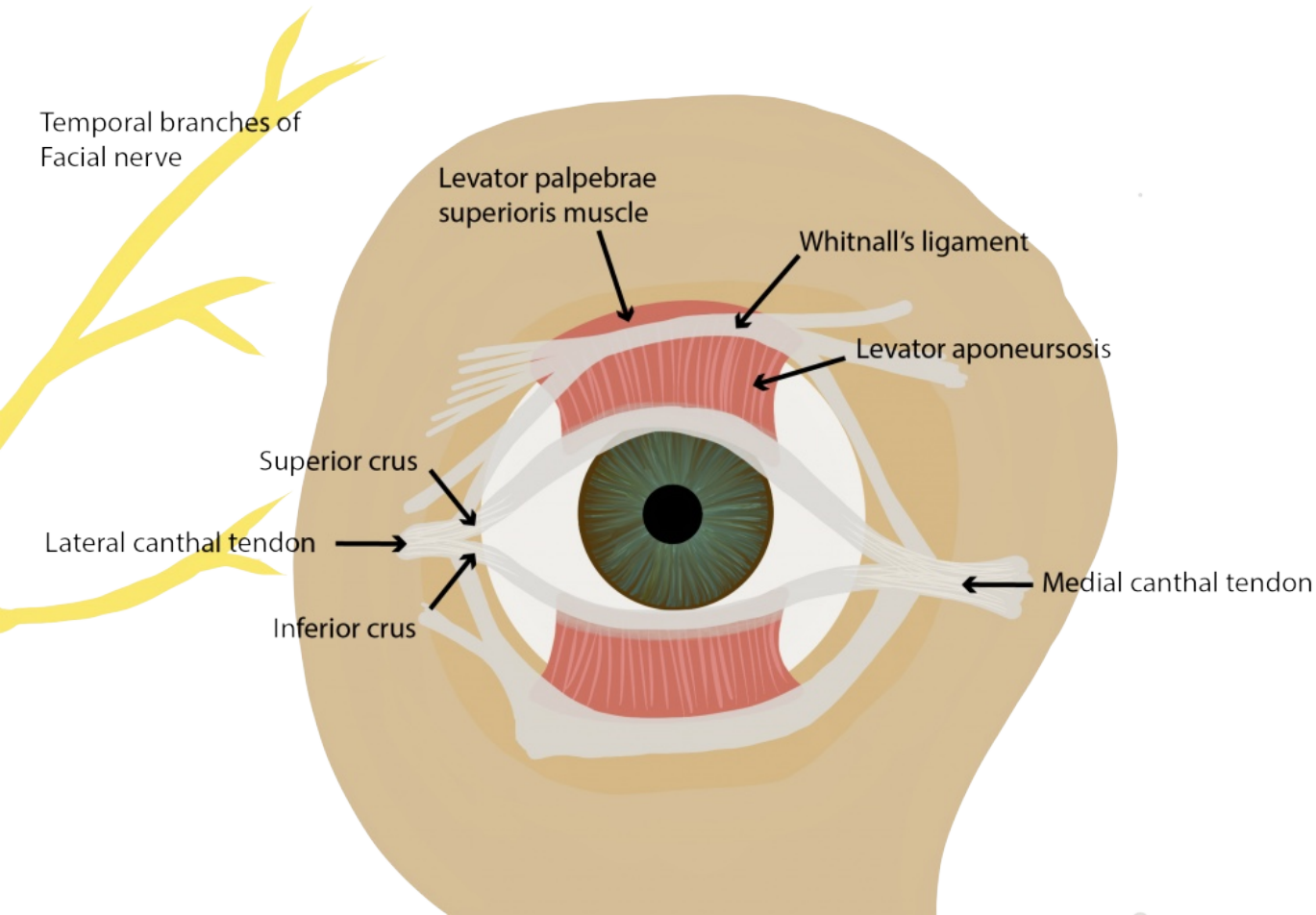


Management

- Decompression should NOT be delayed

You free the eye to go a little bit forward (we're buying time (few hours)) >> this step is reversible meaning if you misdiagnosed the patient there won't be a huge harm but it's lifesaving in the case of orbital compartment syndrome

- Lateral canthotomy and inferior cantholysis.
- Evaluation for and management of coagulopathy and orbital imaging (CT or MRI)
- MRI is contraindicated if a metallic intra-orbital or intraocular foreign body is suspected.



Temporal branches of
Facial nerve

Levator palpebrae
superioris muscle

Whitnall's ligament

Levator aponeurosis

Superior crus

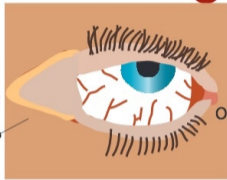
Lateral canthal tendon

Inferior crus

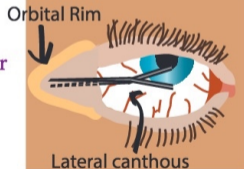
Medial canthal tendon

Performing a Lateral Canthotomy

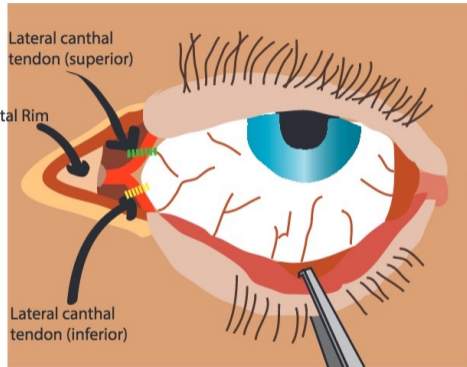
1. Liberally inject surrounding soft tissue with 1% lidocaine with epinephrine.



2. Advance a hemostat from the lateral canthus to the outer orbital rim and clamp to devascularize the tissue. Hold for 30-90 seconds.



3. Use small, sharp scissors (Iris scissors) to cut from the lateral canthus to the outer orbital rim.



4. Use forceps to reflect the lower eyelid to visualize the inferior canthal tendon.

5. Cut the tendon (yellow dotted line) to decompress the globe.

6. If this does not result in reduced IOP, repeat for the upper canthal tendon (green dotted line).

Additional management:

- Elevation of the head of the bed to at least 45 degrees
- Management of increased intraocular pressure Diamox (Acetazolamide) / Mannitol
- Pain control Heavy analgesia : morphine / tramal
- Correction of any coagulopathy and/or cessation of anticoagulant therapy
- Prevention of sudden increased intraorbital pressure by:
 - Cough suppression
 - Antiemetic therapy (eg, ondansetron)
 - Stool softeners to prevent excess straining with bowel movements
- Hospitalization and definitive management of the underlying cause of OCS

Open globe injuries:

- **Open globe rupture:** Occurs following blunt eye injury.

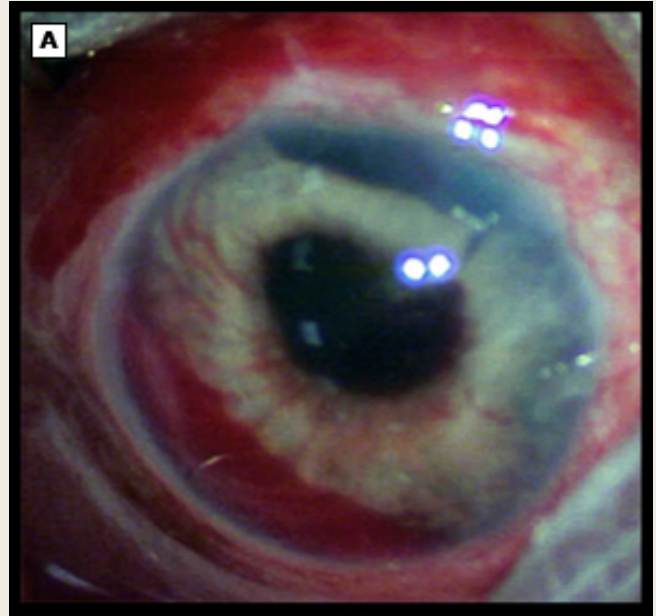
- **Open globe laceration:** Refers to a penetrating injury to the eye by a sharp object.
 - penetrating (entry wound but no exit wound)
 - perforating (entry and exit wounds)
 - Corneal laceration
 - Corneal-scleral laceration
 - Scleral laceration

Signs & Symptoms:

- Markedly decreased visual acuity
- Relative afferent pupillary defect
- Eccentric or teardrop pupil.
- Extrusion of vitreous
- External prolapse of the uvea (iris, ciliary body, or choroid) or other internal ocular structures
- Tenting of the cornea or sclera at the site of globe puncture
- Low intraocular pressure (checked by an ophthalmologist only)
- Seidel sign

Blunt injury to the eye with:

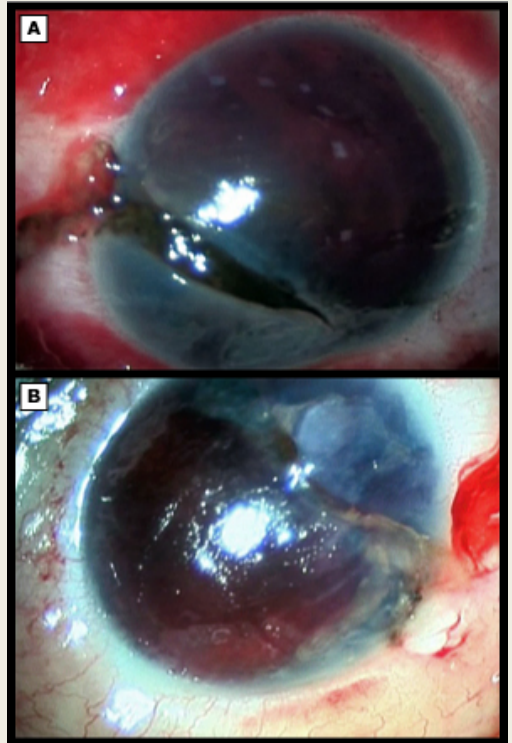
- Subconjunctival hemorrhage superiorly
- Conjunctival laceration
- Hyphema (blood in the anterior chamber)
- Iridodialysis (separation of the iris from its insertion at the ciliary body) superiorly.



Penetrating Injury with:

Important: in an open eye injury >> leave things as they are / eye shield (any sort of pressure you apply trying to examine the eye will lead to further extrusion of interior eye structures)

- Full thickness corneal laceration from a fragment of glass.
- Uveal tissue and aqueous are seen prolapsing through the wound.



Open globe laceration with a teardrop pupil



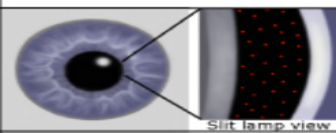


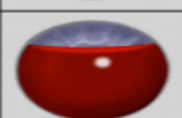
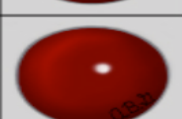
Management:

- Urgent ophthalmologic evaluation
- NPO state
- Prophylactic ^{Broad spectrum} antibiotics to avoid posttraumatic endophthalmitis
- Tetanus prophylaxis for ocular lacerations
- Rapid primary closure of an open globe injury, ideally within 24 hrs
- Rapid closure promotes the best visual outcome

Traumatic hyphema

- Grossly visible blood in the anterior chamber of the eye.
(macroscopic Hyphema)
- Microhyphema describes dispersed red blood cells in the anterior chamber that do not layer out to form a gross fluid level Visible on SLE
- The anterior chamber is anatomically defined as the space bordered by the cornea, iris, angle, and the lens.
- Bleeding results from tears in the vessels of the ciliary body or iris.
- Caused by blunt trauma to the eye or high energy blow to the eye.

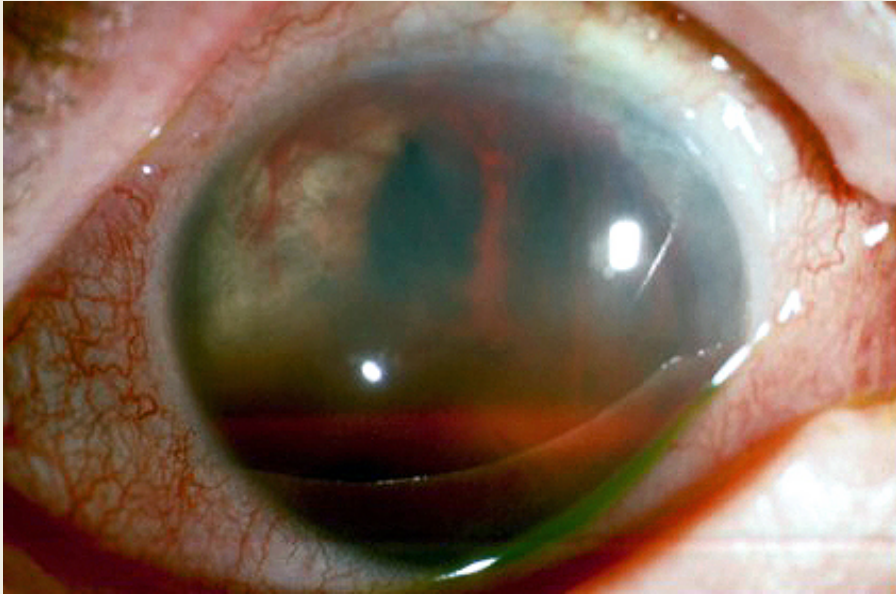
Traumatic hyphema: Grading and prognosis Advanced to our level (read only)

Grade	Anterior chamber filling	Diagram	Best prognosis for 20/50 vision or better
Microhyphema	Circulating red blood cells by slit lamp exam only		90 percent
I	<33 percent		90 percent
II	33-50 percent		70 percent
III	>50 percent		50 percent
IV	100 percent		50 percent

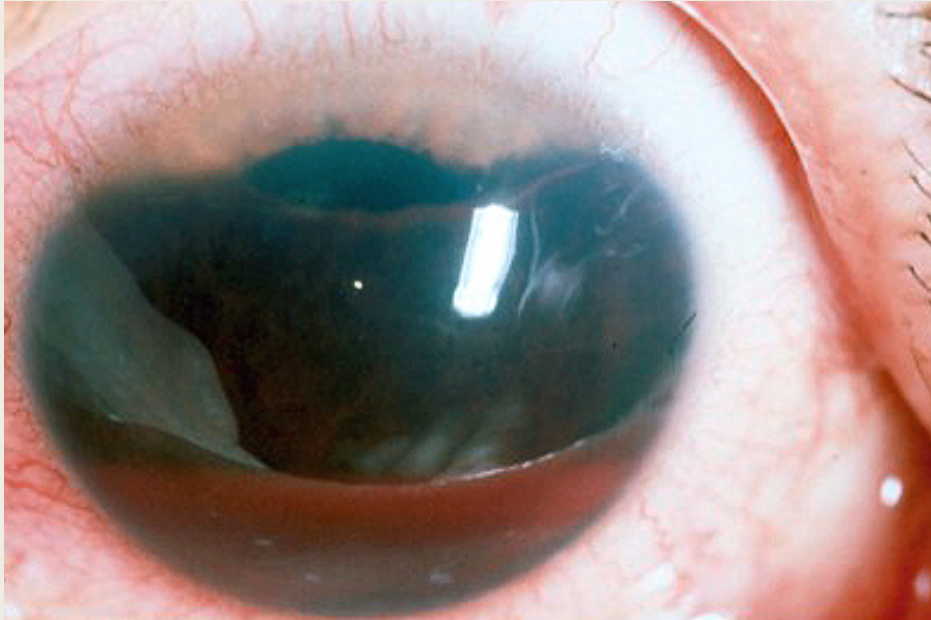
Signs & Symptoms:

- Grossly apparent layer of blood using a penlight.
- Microhyphema, detected by split lamp.
- Photophobia
- Decreased visual acuity
- Anisocoria
- Iridodialysis (tearing of the iris away from its insertion)
- Increased intraocular pressure Clogging of the TM by RBCs

- Grade I to II hyphema inferiorly
- Active bleeding from the superior iris.



- Grade IV hyphema following blunt trauma.



Management:

Preventing secondary hemorrhage and intraocular hypertension, Glaucoma and corneal blood staining by:

- Monitoring of intraocular pressure
- Eye Shield
- Limitation of activity + semi-sitting position to allow gravity to bring blood inferiorly so the patient can see
- Cycloplegia to manage pain
- Glucocorticoid eye drops, to lower the risk of rebleeding.

Management:

- Surgical clot evacuation:

Indications:

- Large persistent hyphemas (\geq grade III for >10 days)
- Early corneal blood staining
- Uncontrolled intraocular pressure (ie, ≥ 50 mmHg for >5 days) despite maximal medical therapy

The most important out of these is uncontrolled IOP +/- early corneal blood staining

Vitreous hemorrhage

- It is extravasation of blood into one of the several potential spaces formed within and around the vitreous body.
- May indicate a retinal tear or detachment. Traction retinal detachment
- May be associated with abusive head trauma in infants and young children.
- Subarachnoid or subdural hemorrhage in patients with significant head trauma.



Retinal trauma

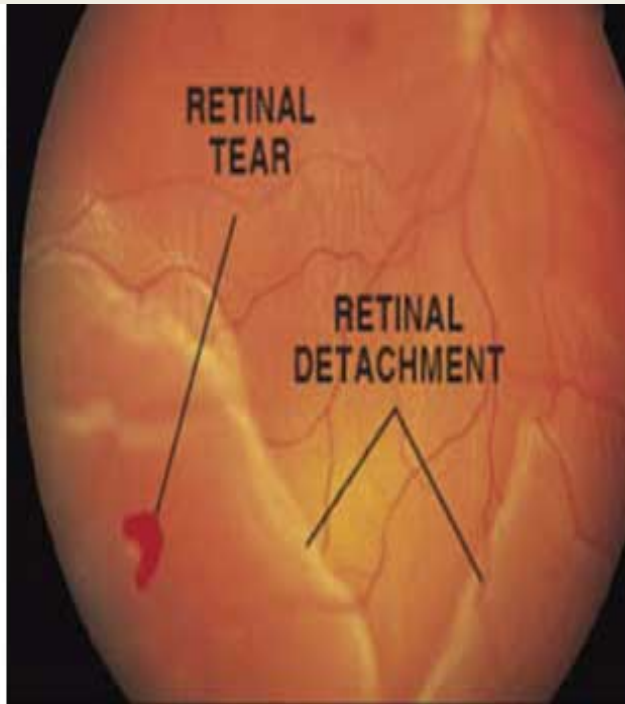
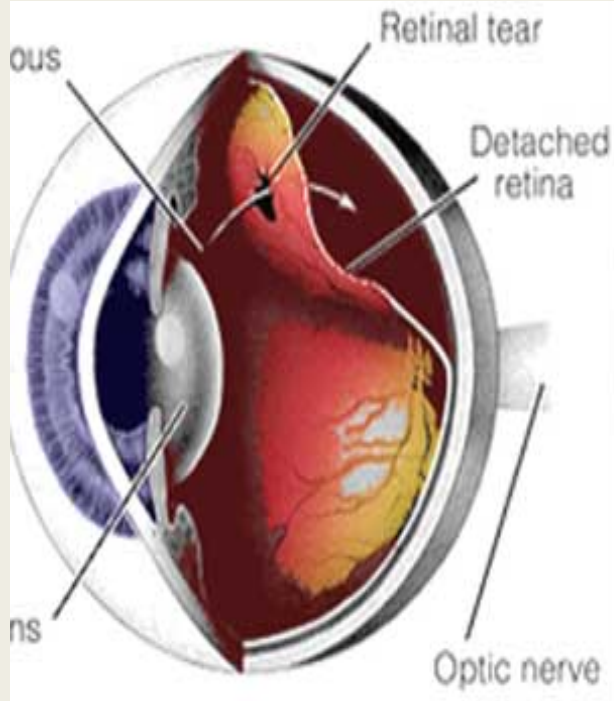
- Traumatic retinal injuries result in loss of vision that may be partial, confined to a visual field, or complete.
- **Retinal detachment:**
 - May cause light flashes, floaters, visual disruption.
 - Patients require bed rest pending urgent surgical repair.
 - The timing of the repair is determined by the location of the detachment.
 - Detachments that threaten the macula and central vision warrant urgent repair.

Macula on / off

** If off > urgent surgery

** If on : the detachment is superior to the macula > urgent surgery

the detachment is inferior to the macula > the surgery can be delayed for few days



■ **Commotio retinae:**

- Refers to retinal edema after blunt closed globe injury.
- May be asymptomatic or cause decreased vision in affected patients.
- Ophthalmoscopy shows retinal whitening with normal vessels.
- Retinal hemorrhage may also be seen.
- It typically resolves without intervention.
- Exclusion of associated retinal break or detachment is important

Commotio
retinae



Optic nerve injury

- Known as traumatic optic neuropathy
- Causes decreased vision, including desaturation of red color or decreased color vision in the affected eye
- Afferent pupillary defect.

- Mechanisms of injury are as follows:
 - **Direct nerve injury:** uncommon, due to a lacerating injury
 - **Indirect nerve injury:** more common, results from contusion of the nerve within the optic canal. The usual cause is a forceful blow to the temple or the brow.

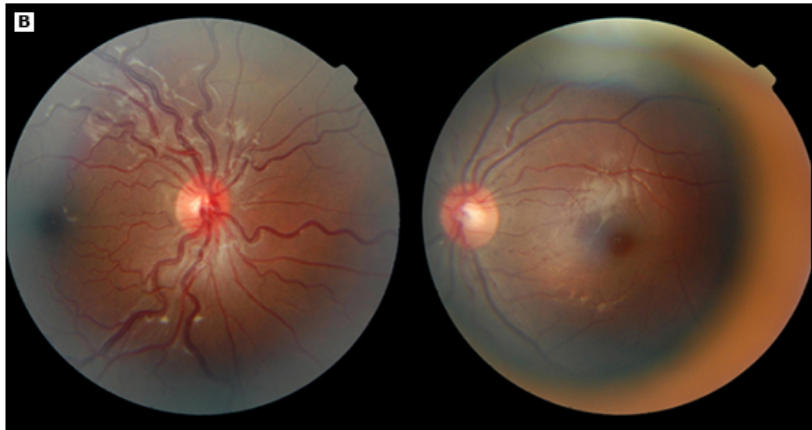
Periocular injuries that threaten vision

- Head trauma can cause a carotid cavernous sinus fistula.
- Ocular surface vessels appear tortuous (termed "corkscrew") and dilated with concomitant chemosis (edema of the conjunctiva).
- Retinal vessel distension and high intraocular pressure.

- Mild proptosis and engorgement of the episcleral vessels.



- Dilatation of the retinal vasculature



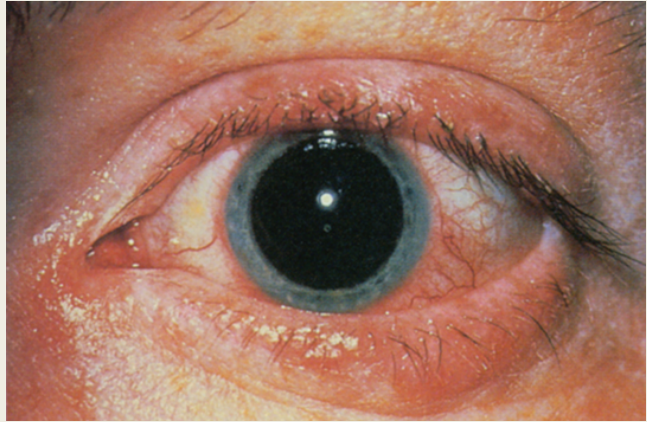


RED EYE

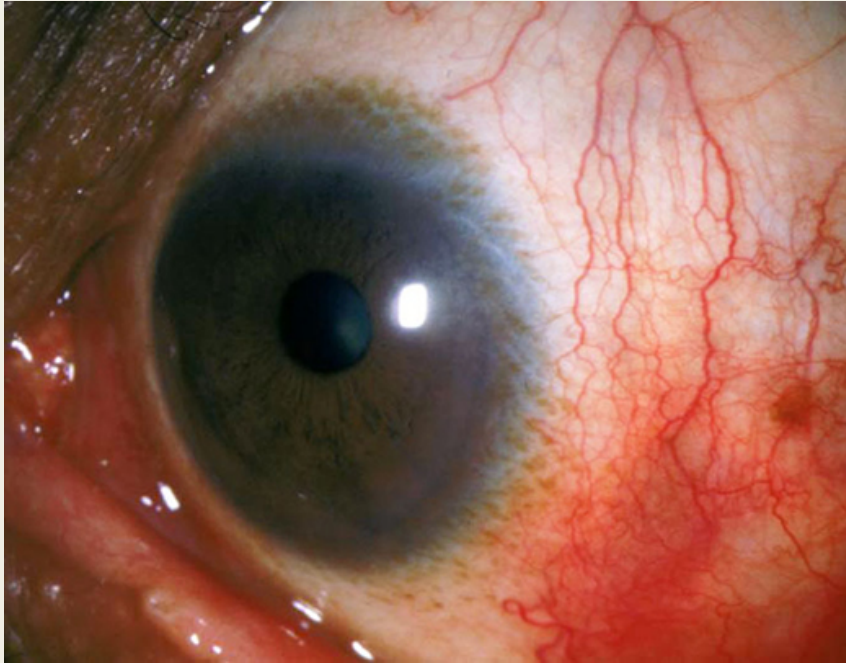
DDx of Red eye: Benign conditions

- Stye (hordeolum)
- Chalazion
- Blepharitis
- Subconjunctival hemorrhage
- Conjunctivitis
 - Bacterial
 - Viral
 - Allergic
- Corneal abrasion (urgent follow-up if not better in 24 to 48 hours)
- Corneal foreign body (urgent follow-up if not better in 24 to 48 hours)
- Contact lens overwear (urgent follow-up if not better in 24 to 48 hours)
- Dry eye syndrome

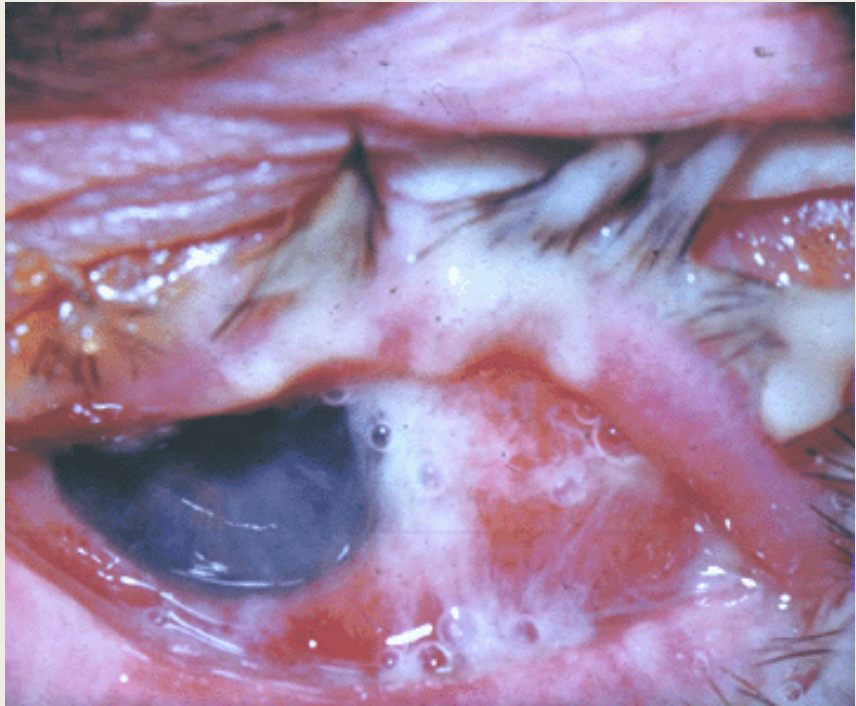
Blepharitis



Episcleritis



Bacterial conjunctivitis



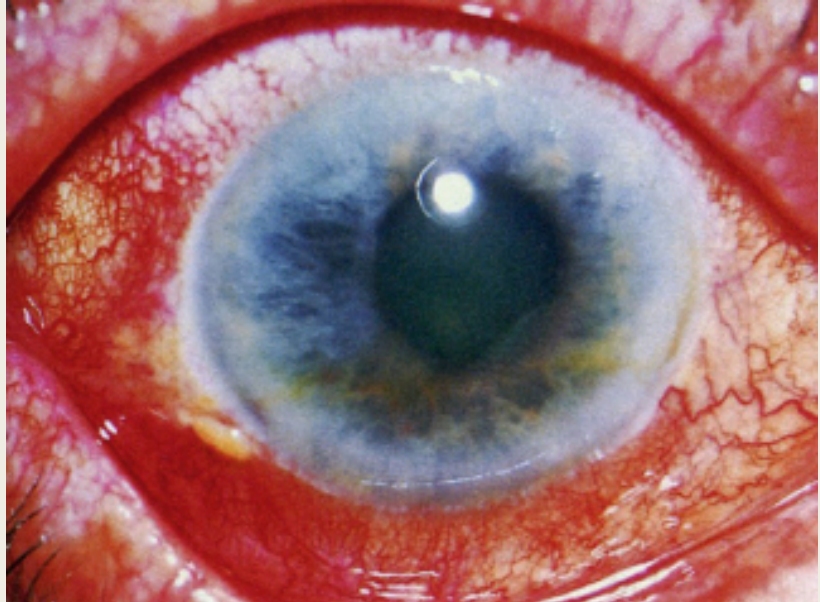
DDx of Red eye: Serious conditions

● Angle-closure glaucoma	Emergency
● Hyphema	Emergency
● Hypopyon	Emergency
● Iritis	Urgent
● Infectious keratitis	
● Bacterial	Emergency
● Viral	Urgent
● Scleritis	Urgent

Acute angle-closure glaucoma

- The conjunctival vessels are dilated, especially near the cornea (ciliary flush).
- The cornea is slightly hazy (edematous).

How to differentiate between orbital compartment syndrome and acute angle-closure glaucoma ?
High pressure outside the eye vs high pressure inside the eye



Hypopyon

- Leukocytic exudate seen in the anterior chamber.



Reference:

- <https://www.uptodate.com/contents/overview-of-eye-injuries-in-the-emergency-department>

Thank you