

Ocular Trauma and Emergencies

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Epidemiology

- Accidental eye injury is one of the leading causes of visual impairment
- >2.4 million eye injuries in the US per year
- 90% are preventable

- Most common cause of visual loss in persons under age 25

Epidemiology

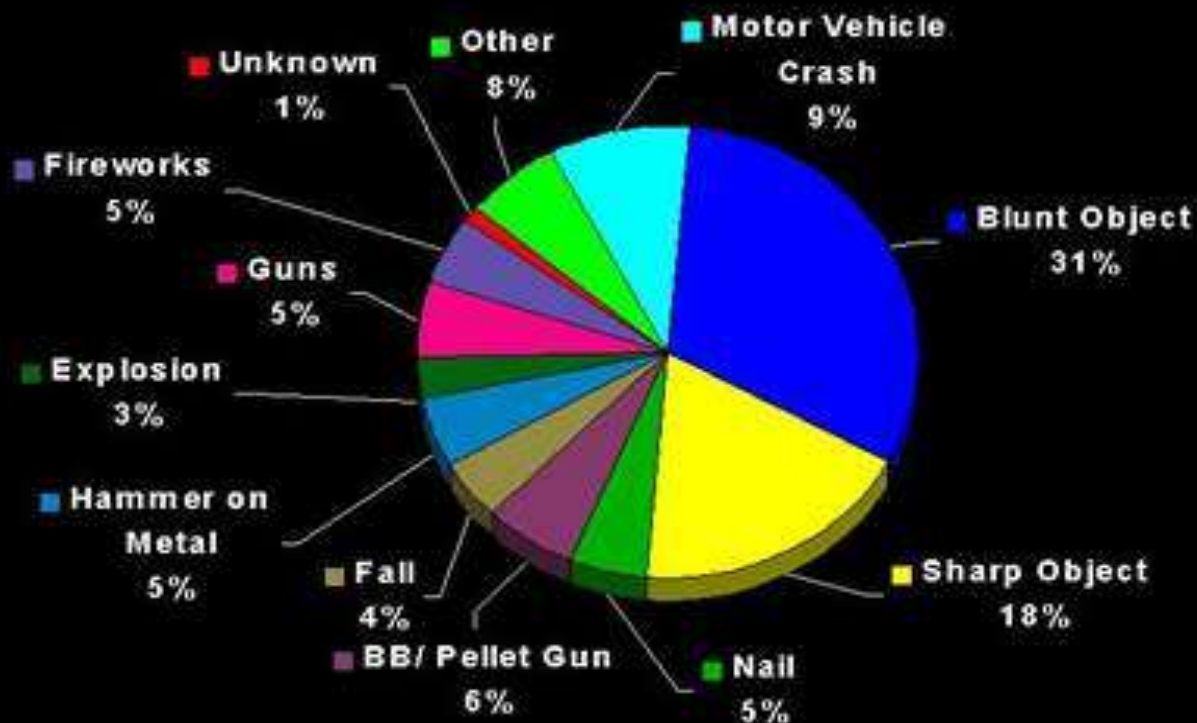
- Leading causes:
 - Sports accidents
 - Consumer fireworks
 - Household chemicals and battery acid
 - Workshop and yard debris

- 48% of eye injuries occur at home
 - 1 in 5 are due to home repair or power tool use



Epidemiology

Source of Eye Injury



History

- Age
- Occupation
- Brief history of accident
- Specific symptoms
- Prior condition of eyes
- General health
- Allergies
- Tetanus prophylaxis

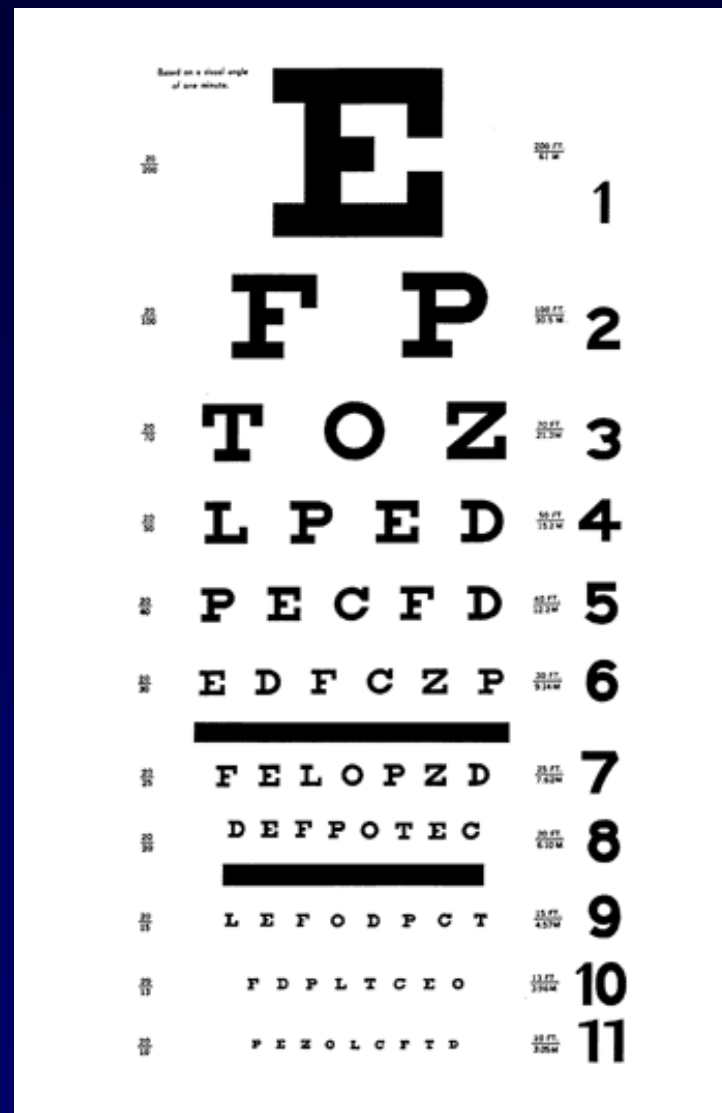
Examination - Inspection

- Gross appearance
- Hand held light or penlight
- Slit lamp
- Fluorescein and Wood's lamp
- Direct ophthalmoscope

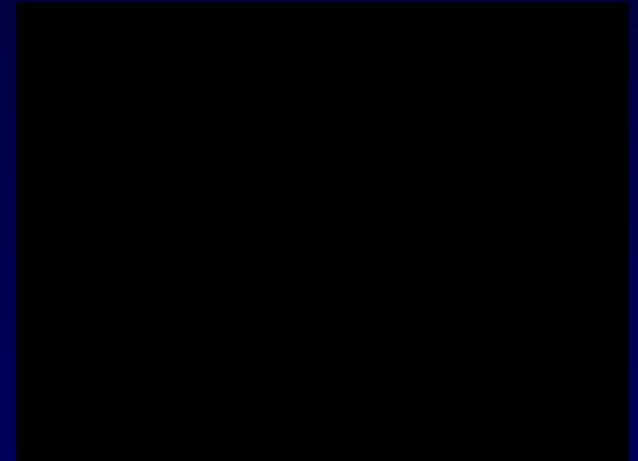
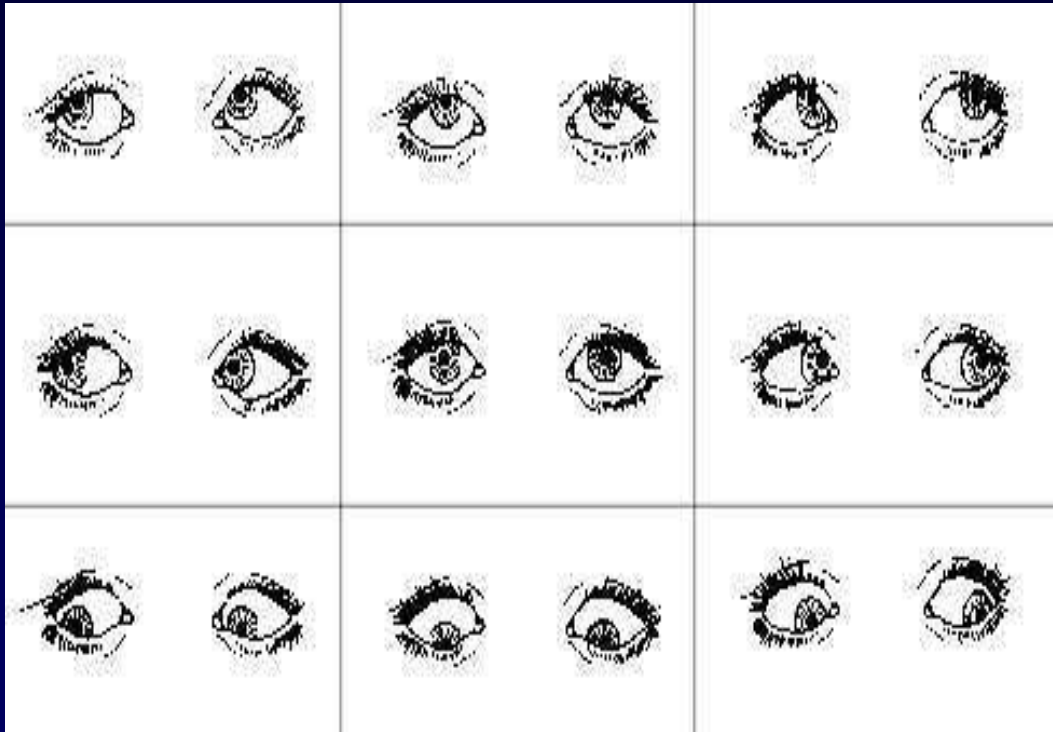
Examination

- Visual Acuity
- Motility
- Pupils
- Visual Field
- Inspection

Examination - Acuity

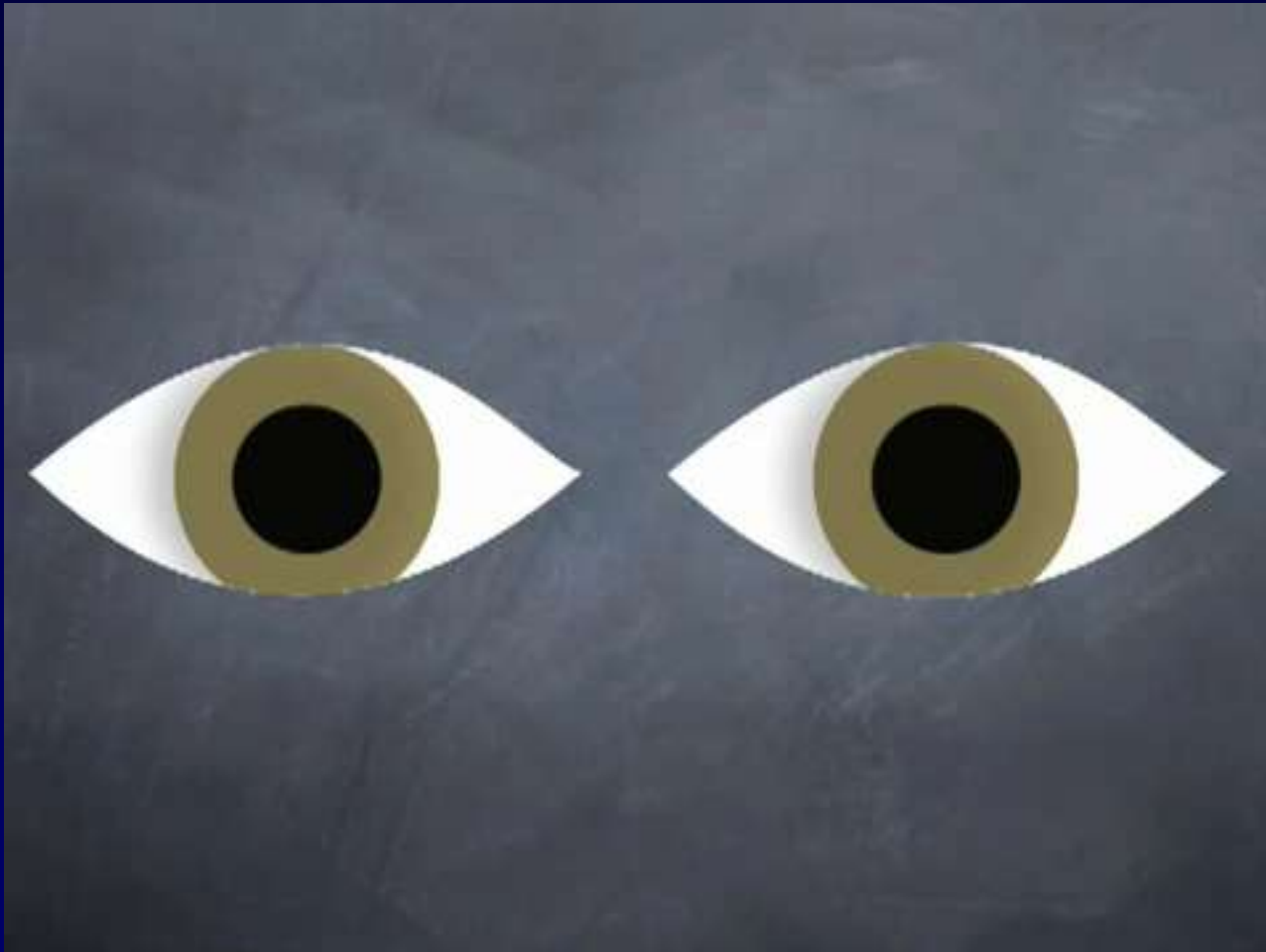


Examination - Motility

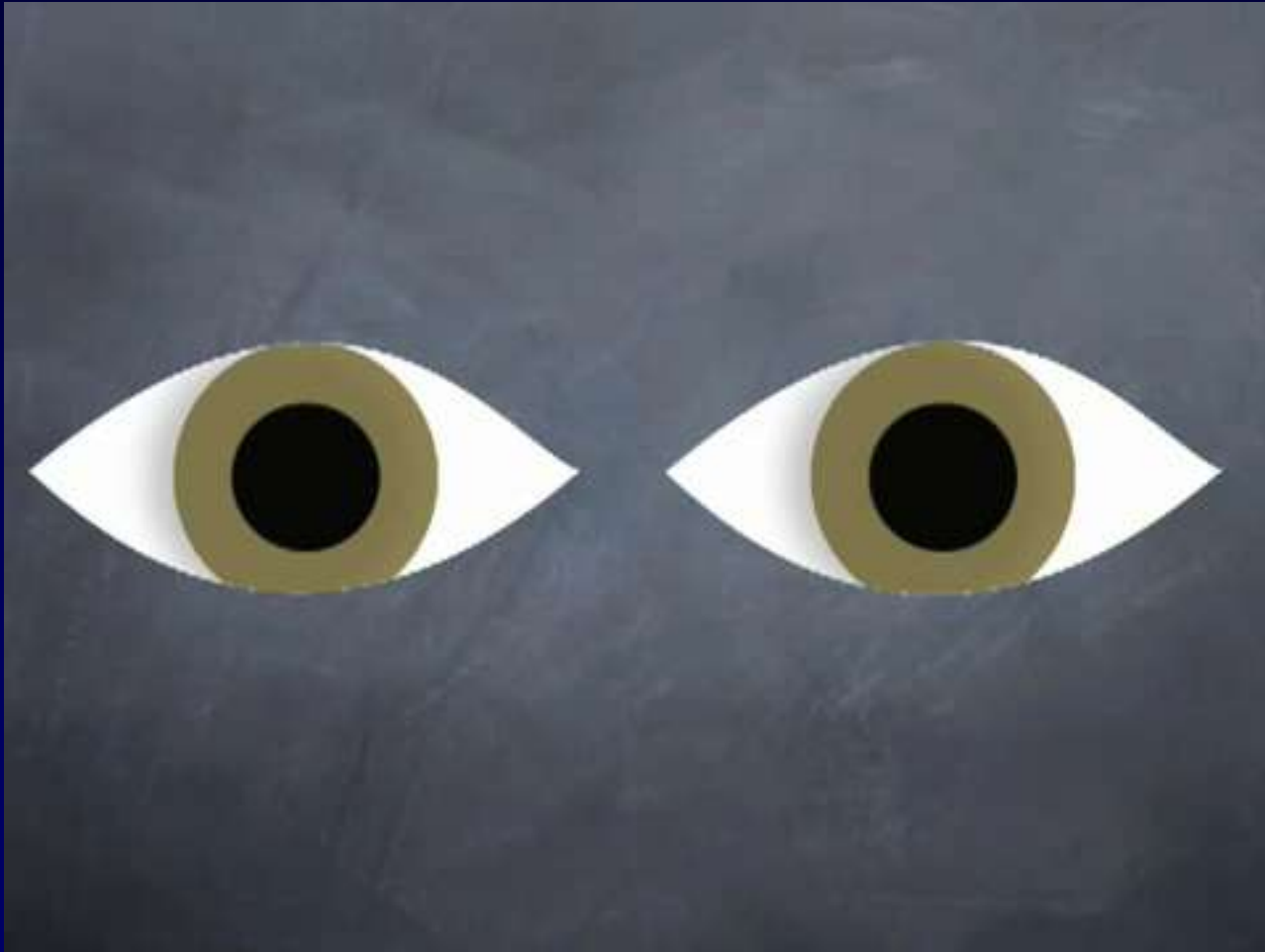


Pupils

- Direct & Consensual Response
- “Swinging Flashlight” Test

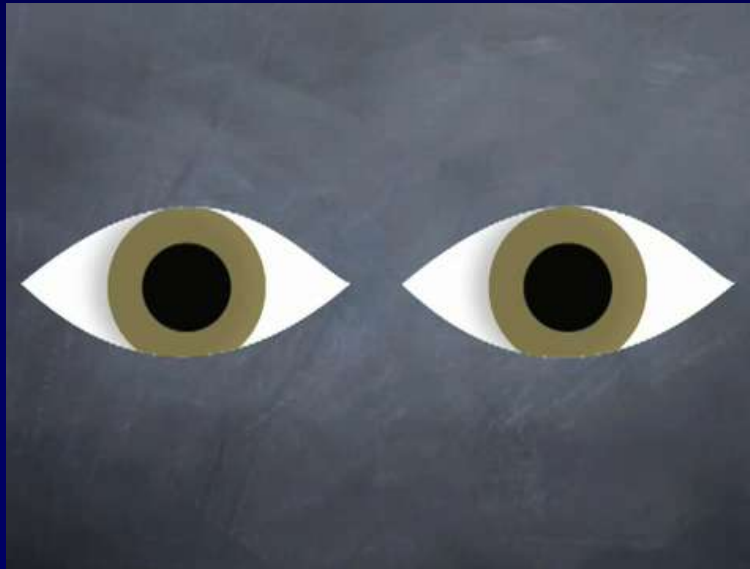


Pupils: RAPD

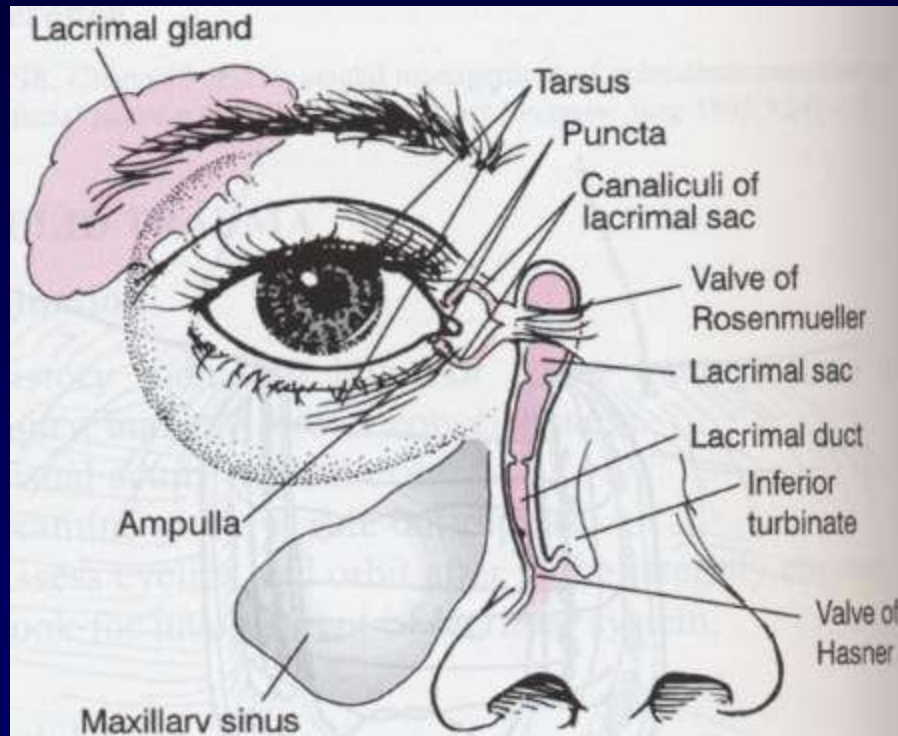


RAPD

- Optic Neuritis, Optic Nerve compression, Optic Nerve ischemia
- Central Retinal Artery or Vein Occlusion
- Large Retinal Detachment



Eyelid Anatomy



Anatomy of the Eye

Outside the Eye

cornea

iris

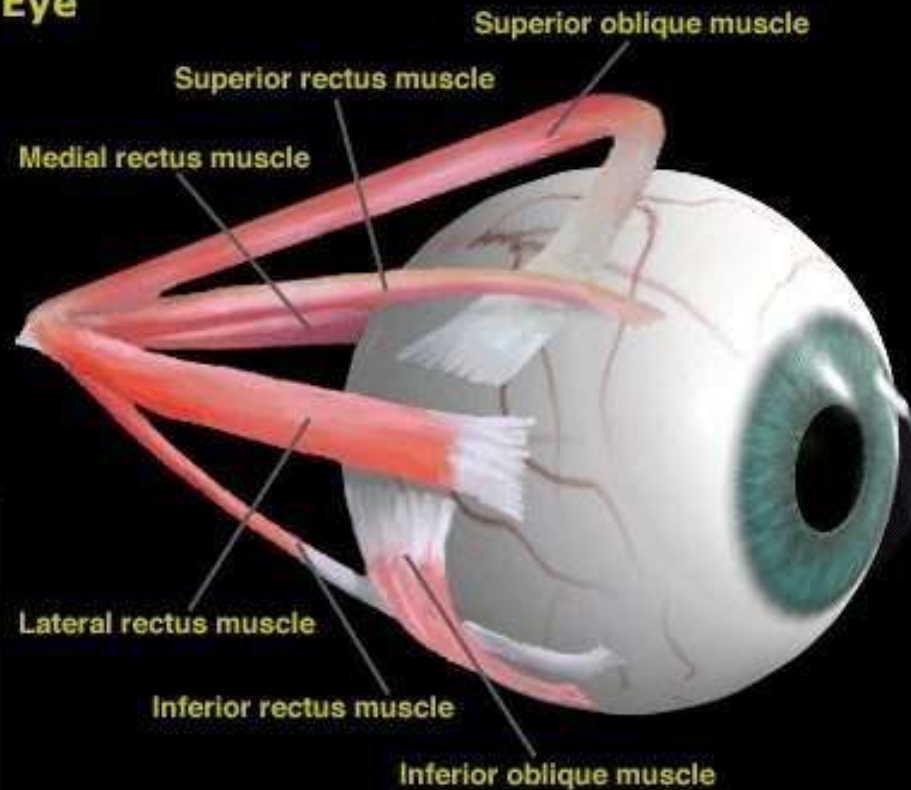
muscles

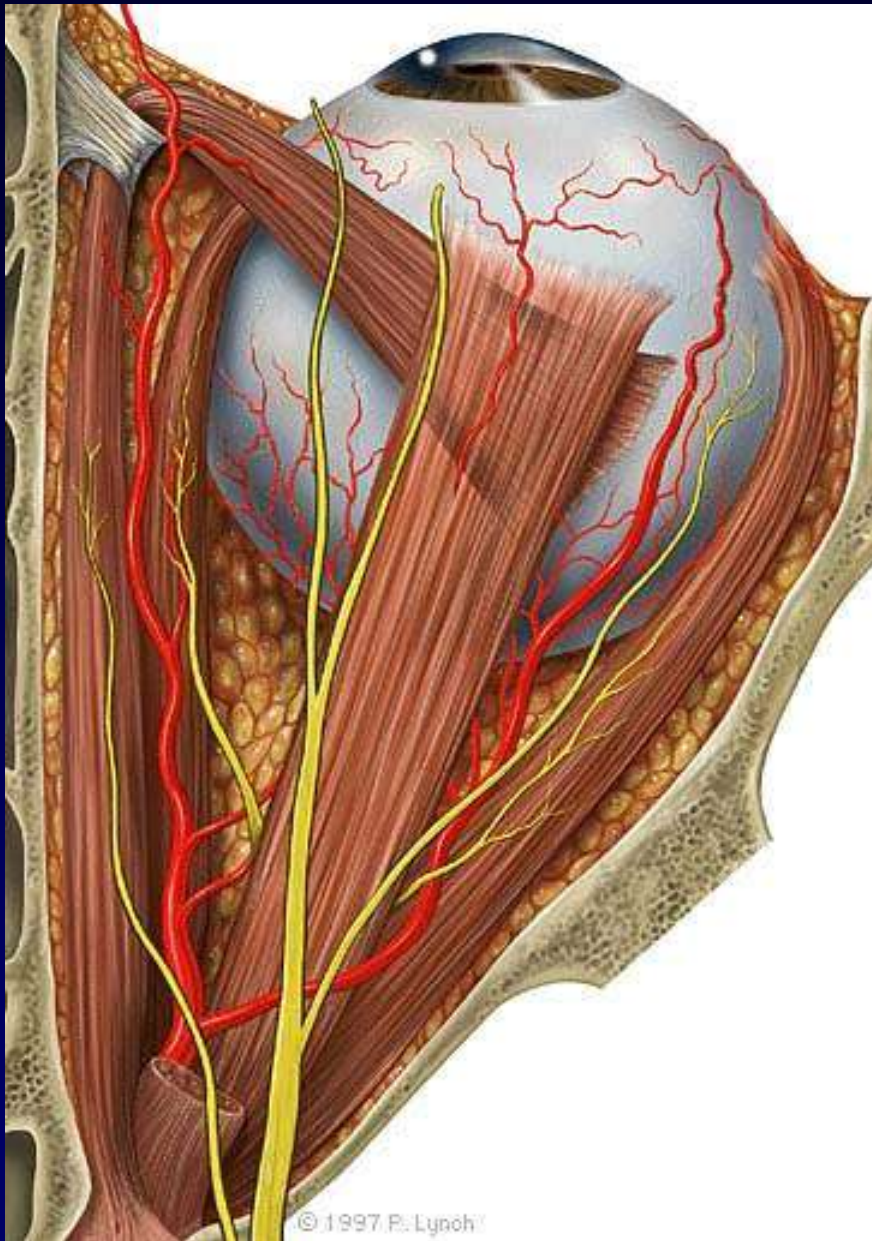
optic nerve

pupil

sclera

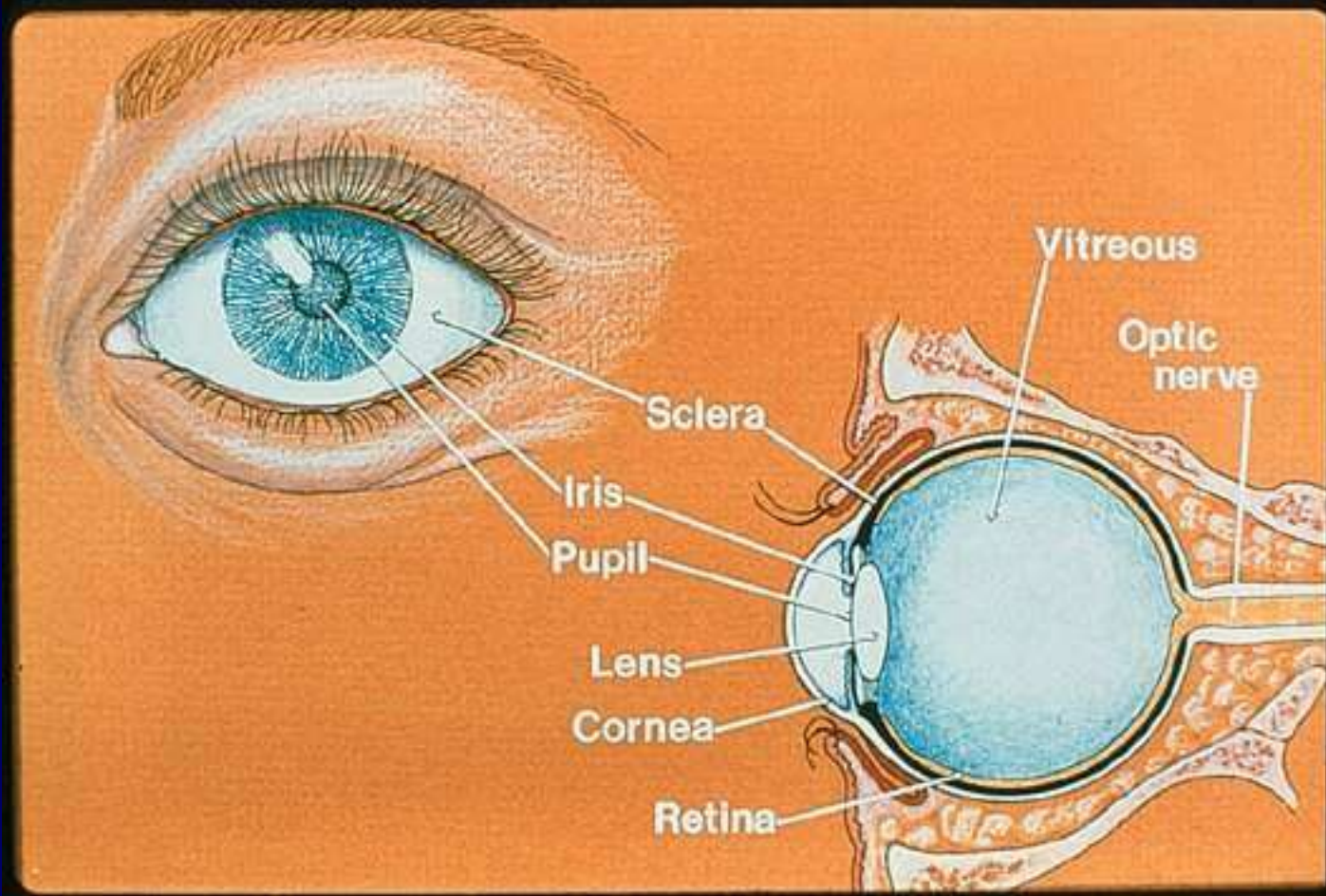
There are six extraocular muscles that work together to move each eye in its socket. One muscle moves the eye to the left, one moves the eye to the right, two move the eye up, and two move it down.

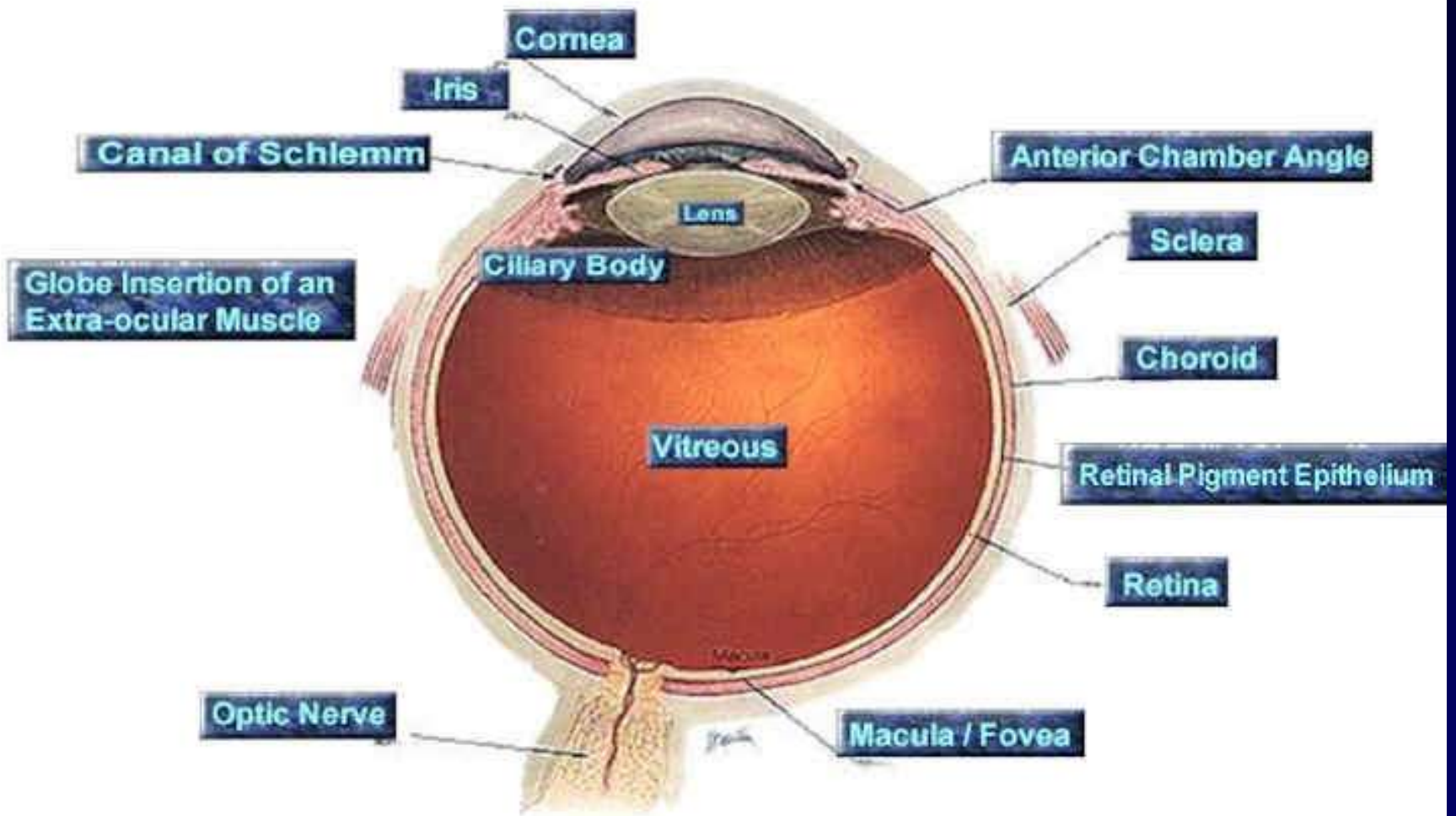




Extraocular Muscles

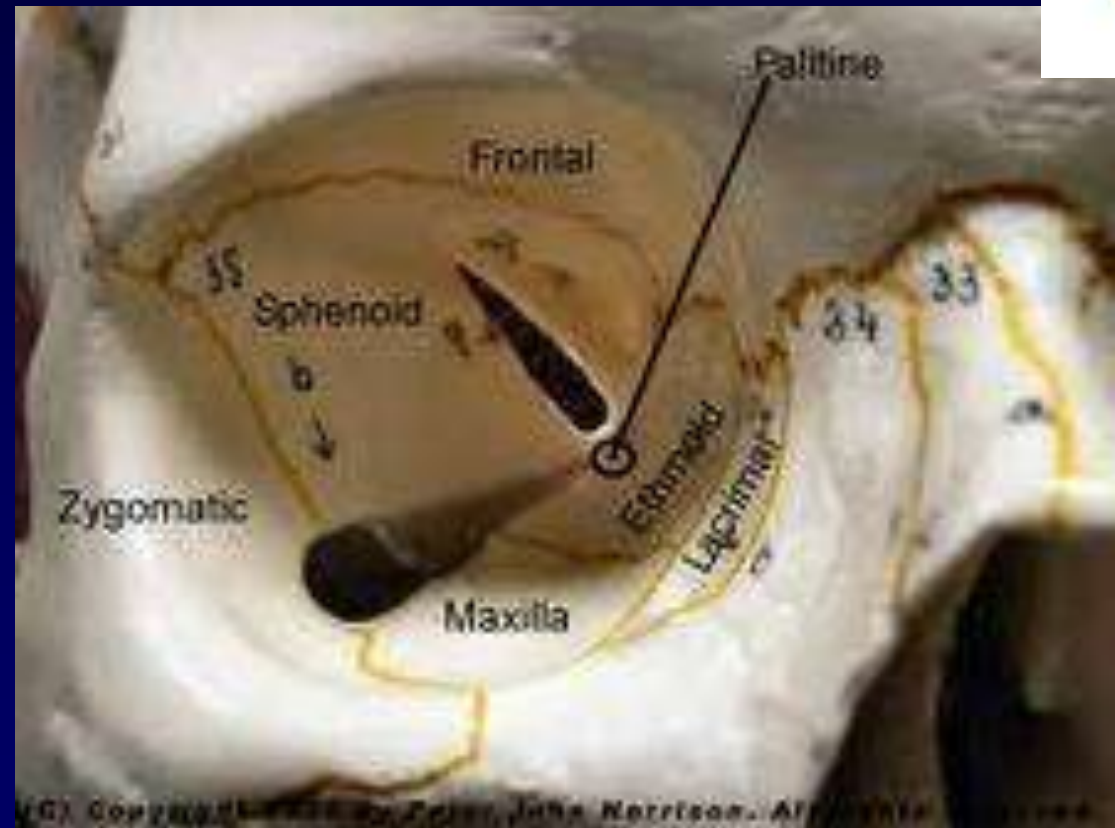
Review of Anatomy





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Skull – Anterior View (2)



Timing of Emergent Evaluation

- Within minutes:
 - Retinal artery occlusion
 - Chemical burns

- Within hours:
 - Endophthalmitis
 - Intra-ocular foreign bodies
 - Orbital cellulitis

Methodology

- When evaluating ocular emergencies and ocular trauma think anatomically anterior to posterior.
- Skin
- Orbit
- Nerves
- Globe (cornea, anterior chamber, iris, lens, vitreous, retina)

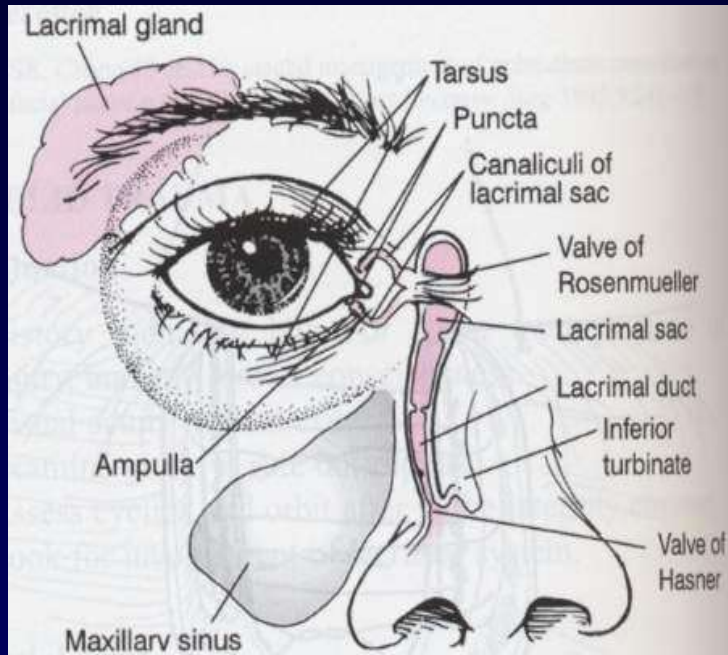
Emergent Clinical Scenarios

- Splash injury
- Sudden painless atraumatic loss of vision
- Transient atraumatic loss of vision
- Sudden painful atraumatic loss of vision
- Blunt injury
- Penetrating injury
- Atraumatic double vision (diplopia)
- Traumatic double vision
- Acute visual distortion
- Acute visual disturbance in immunocompromised individual

Emergent Clinical Scenarios

- Acute visual disturbance in post-op patient
- Floaters
- Flashes of light
- Acute proptosis
- Acute red eye
- Sudden corneal foreign body sensation
- Acute periocular pruritis
- Acute tearing
- Acute atraumatic periocular pain
- Atraumatic periocular swelling
- Acute eyelid twitching
- Acute eyelid droop
- Anisocoria
- “Blurred” optic nerve head

Eyelids & Orbital Emergencies

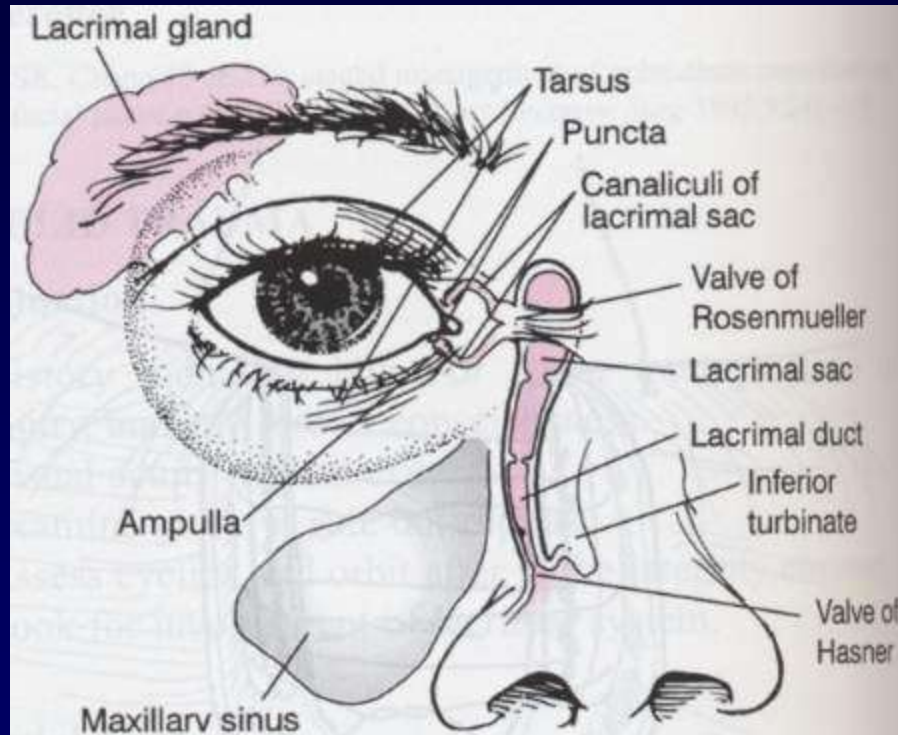


Super Glue

- Warm compress to loosen
- May need to trim lashes
- Gently rub to remove
- Remove glue from Cornea – Refer to Ophthalmology
- Treat Corneal Abrasion if present



Eyelid Lacerations



Eyelid Lacerations

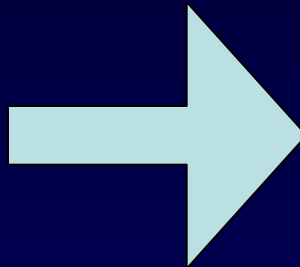
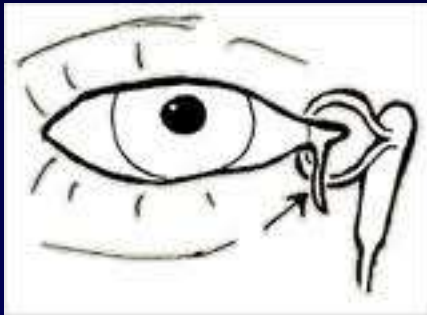
- Should always be concerned about underlying open globe
- Refer to ophthalmologist for
 - Full-thickness laceration
 - Laceration involving medial $\frac{1}{3}$ of lid
 - Deep lacerations with or without fat prolapse
 - Lacerations with significant tissue loss
- Cover with damp, sterile dressing

Eyelid Lacerations



Full-thickness Lid Laceration

Eyelid Laceration



Canalicular Lacerations



Acute Eyelid Droop

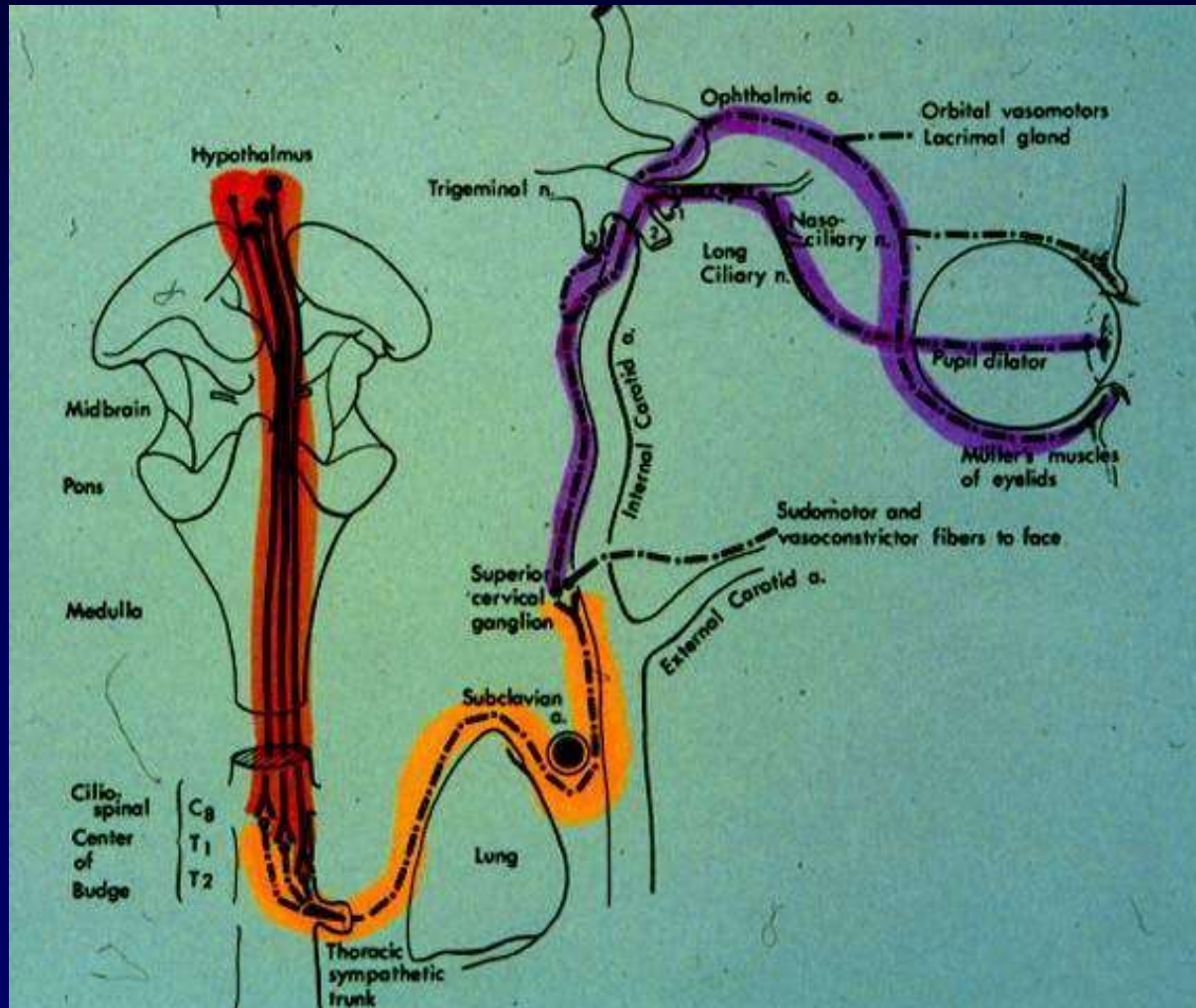
- Horner's syndrome
- 3rd Cranial nerve palsy
- Following intra-ocular surgery/trauma

- Myasthenia gravis
- Corneal trauma (cornea abrasion)
- Botulinum toxin
- Aging (chronic)

Horner's syndrome

- Injury somewhere along the sympathetic autonomic nervous system to the face.
- Caused by interruption somewhere along the sympathetic chain (see diagram)
- Symptoms: ptosis, miosis (constricted pupil).
- Signs: lower IOP, anhidrosis (loss of sweating).
- 3 important facts – ptosis, miosis, anhidrosis
- Refer to ophthalmologist or neurologist

Horner's syndrome



Horner's syndrome



Horner's syndrome



Horner's syndrome



3rd Cranial nerve palsy

- Acute onset of double vision, may be horizontal or vertical, disappears when one eye is closed.
- Ptosis, eye is “**down and out**” (CN IV and VI nl) with limited mobility.
- **If pupil involved (dilated relative to other eye)** then **immediate imaging** is required (to rule out mass lesion compressing brain stem).
- Can be painful if diabetes is the etiology
- Consult with an ophthalmologist or neurologist immediately

3rd Cranial nerve palsy



Left 3rd Nerve Palsy



Patient looking to
her Right --
Left eye cannot
ADduct

Orbital Trauma & Emergencies

- Orbital hematoma
- Orbital fractures
- Orbital Foreign Body
- Proptosis



Acute Proptosis



Acute Proptosis

- Orbital cellulitis
- Orbital pseudotumor
- Vascular abnormalities: carotid-cavernous sinus fistula, varix
- Retrobulbar hemorrhage

- Graves' orbitopathy
- Orbital vasculitis: polyarteritis nodosa, Wegener's granulomatosis, temporal arteritis
- Granulomatous disease: sarcoidosis
- Orbital tumors: primary, secondary, metastatic

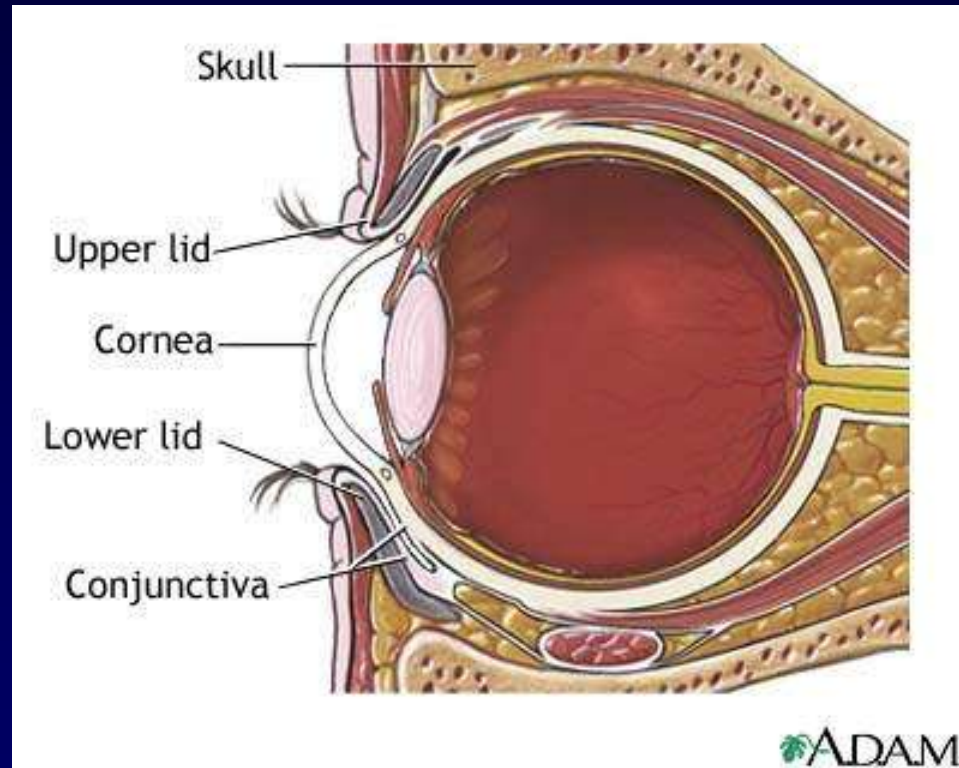
Acute Periocular Pain

- Sinusitis
- Dry eyes
- Orbital pseudotumor
- Optic neuritis
- Diabetic cranial nerve palsy
- Orbital cellulitis
- Preseptal cellulitis
- (many others)

Orbital Cellulitis

- Cellulitis posterior to the orbital septum
- Symptoms - Red eye, pain, **blurred vision**, headache, double vision
- Signs - Eyelid edema, erythema, warmth, tenderness. **Proptosis, restricted ocular motility with pain on attempted movement.**
- Tx – consult ophthalmologist and obtain orbital CT. Will require oral/IV antibiotics.
- Needs to be differentiated from preseptal cellulitis which has salient features that differentiate the two including no vision changes, no restriction of eye movements

Orbital Cellulitis vs. Preseptal Cellulitis



Preseptal Cellulitis



Figure 1 - Preseptal cellulitis



Orbital Cellulitis



Orbital Cellulitis



Orbital Cellulitis



Orbital Hematoma

- If mild, treat with cool compresses
- If large amount of hemorrhage, especially behind the globe (**Retrobulbar hemorrhage**)
 - may require emergency surgery to reduce intraocular pressure and protect corneal surface



Periorbital Hematoma

Retrobulbar Hemorrhage

- Pain, decreased vision
- Proptosis
- RAPD
- Decreased Color Vision
- Elevated IOP
- May see on CT
- Immediate Ophth. consultation



Retrobulbar Hemorrhage



Lateral Canthotomy & Cantholysis

Orbital Fractures

- Diplopia
- Epistaxis
- Decreased facial sensation (infraorbital nerve)
- Crepitus
- Possible palpable bony “step-off”
- If severe, may have restriction of eye movement or enophthalmos



Inferior Rectus Muscle Entrapment



Patient Cannot Elevate Right Eye

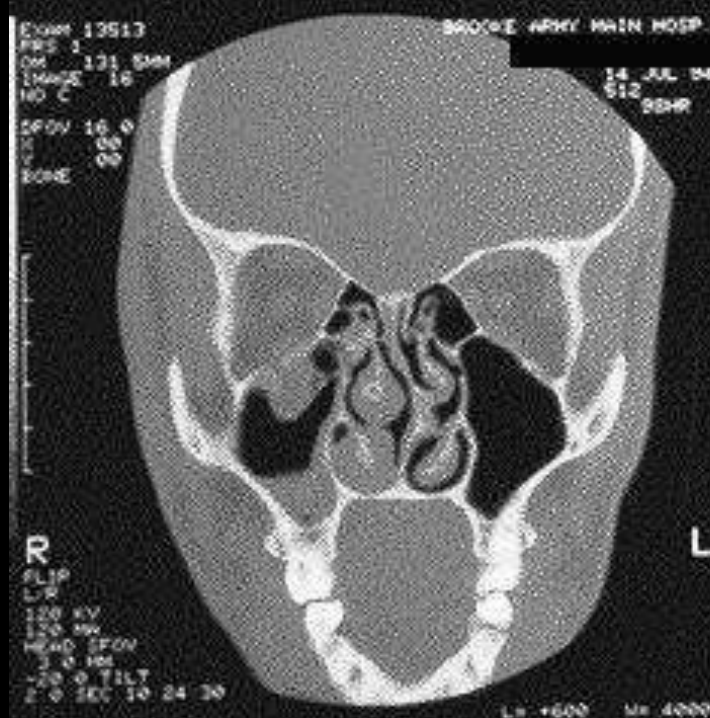
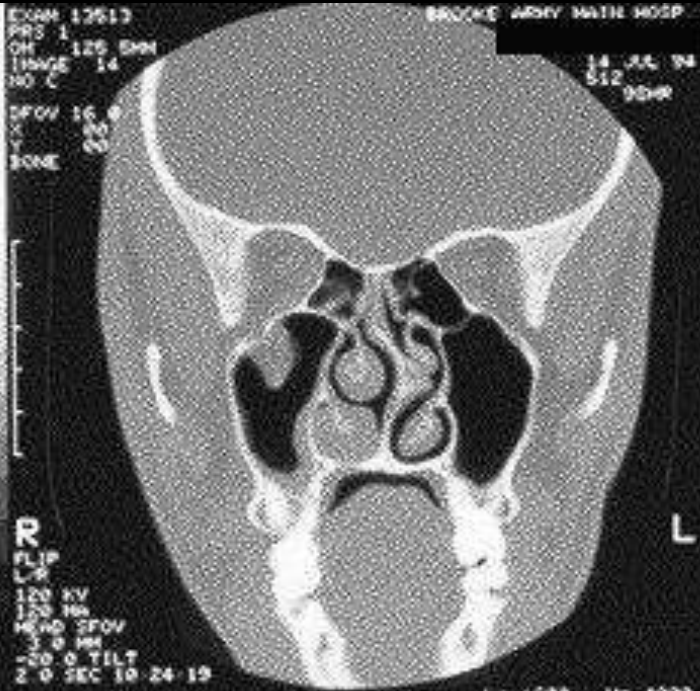
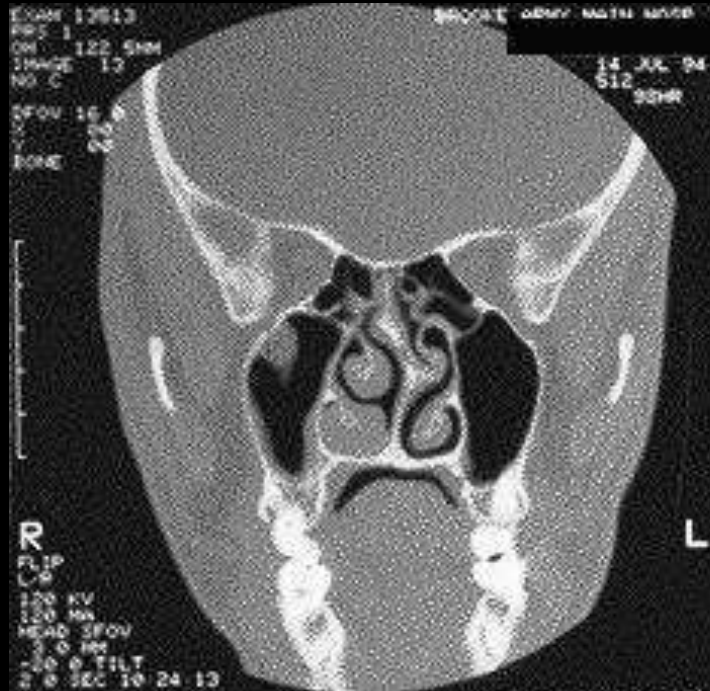
Orbital Fracture



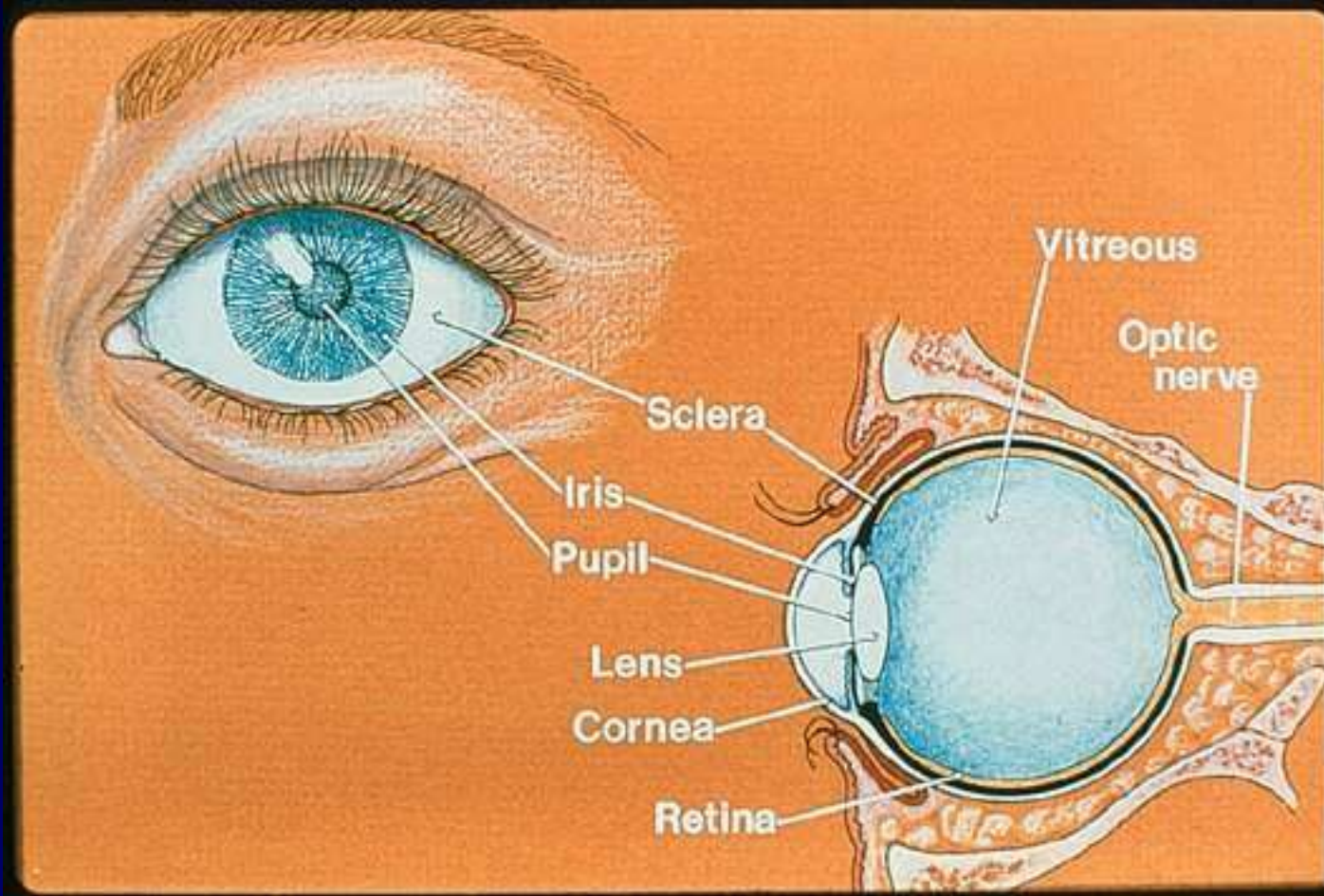
Traumatic Enophthalmos

Orbital Fractures

- CT scan – axial and coronal (thin cuts)
- Surgery not required unless persistent diplopia or poor cosmesis
- Surgery is usually delayed for 7-14 days to allow for resolution of swelling
- Nasal decongestants, oral antibiotics, ice packs
- Instruct patient not to blow nose (1-2 days)



Anterior Segment



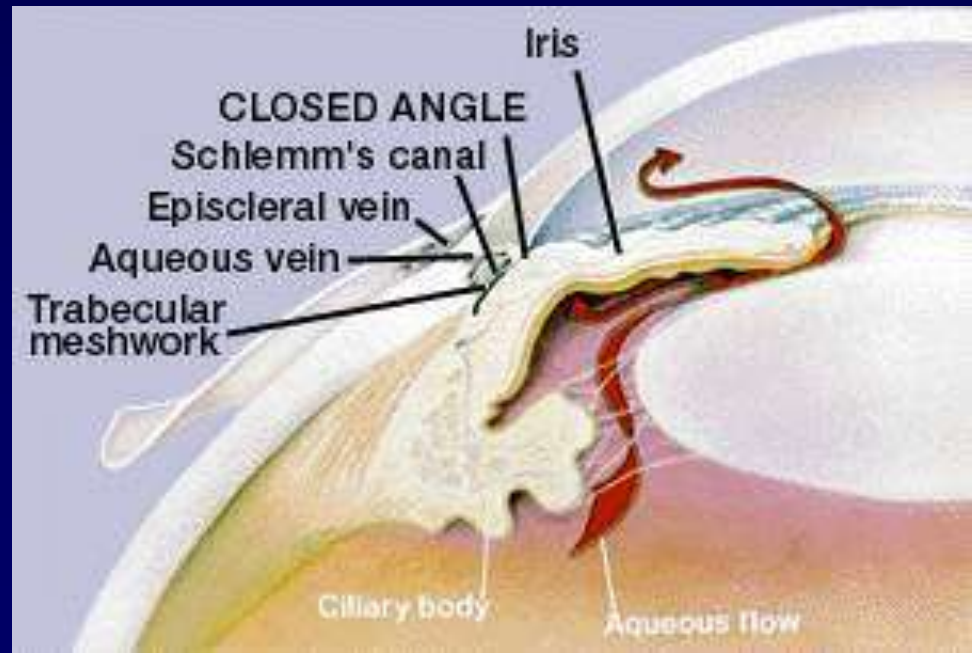
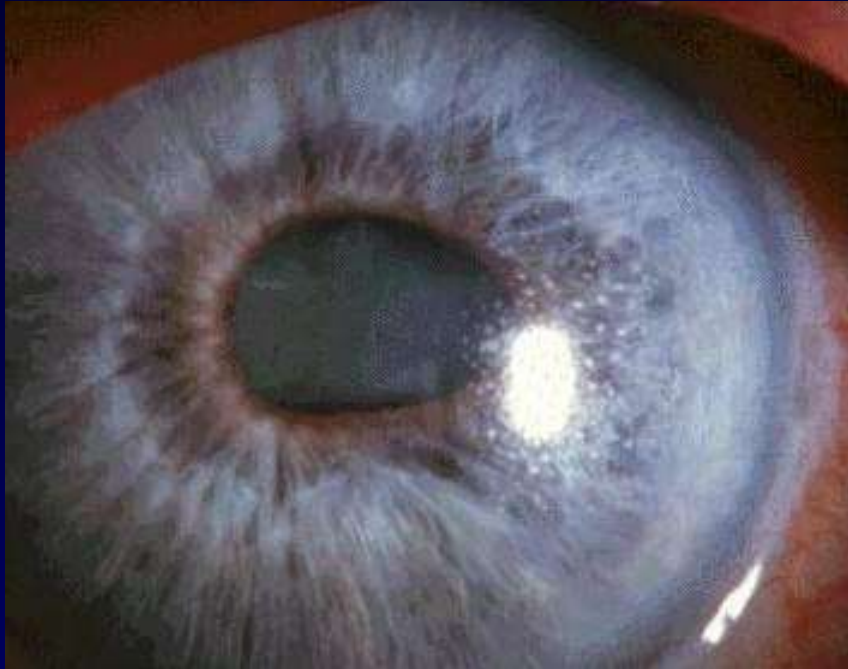
Acute red eye

- Acute elevation in intra-ocular pressure
 - Acute angle-closure glaucoma
- Infection
 - Iritis/iridocyclitis
 - Conjunctivitis
 - Herpes simplex keratitis
- Inflammation/autoimmune
 - Episcleritis
 - Scleritis
 - Adnexal disease (lids, lacrimal apparatus, orbit)
 - Subconj hemorrhage
 - Pterygium
- Trauma
 - Corneal abrasions and foreign bodies
- Secondary to abnormal lid function

Acute angle-closure glaucoma

- Deep, boring pain unilateral located “in the eye”
- Haloes, nausea and vomiting common
- Acute rise in intra-ocular pressure (normal 12-18 mmHg), **can be up to 60's** in angle-closure glaucoma
- Reduced visual acuity
- Red eye, hazy cornea and the iris is not clearly visible
- Pupil is fixed or semi-dilated, unreactive to light
- **Requires immediate referral to ophthalmologist for pressure lowering medications or surgery**
- Damage occurs to the optic nerve due to the drastically elevated intra-ocular pressure

Acute angle-closure glaucoma



Chemical Burns

**Irrigate immediately
before
anything else**

Alkaline (bases)

- Fertilizers
- Cleaning products (ammonia)
- Drain cleaners (lye)
- Oven cleaners
- Bleach (sodium hydroxide)
- Fireworks (magnesium hydroxide)
- Cement (lime)

Alkaline (bases)

- High pH
- Especially damaging – will denature proteins and lyse cell membranes which enhances penetration

Acids

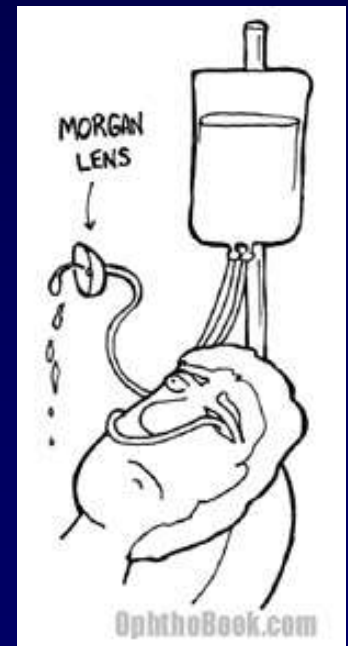
- Battery acid (sulfuric acid)
- Glass polish/etching (hydrofluoric acid)
- Vinegar, nail polish remover (acetic acid)

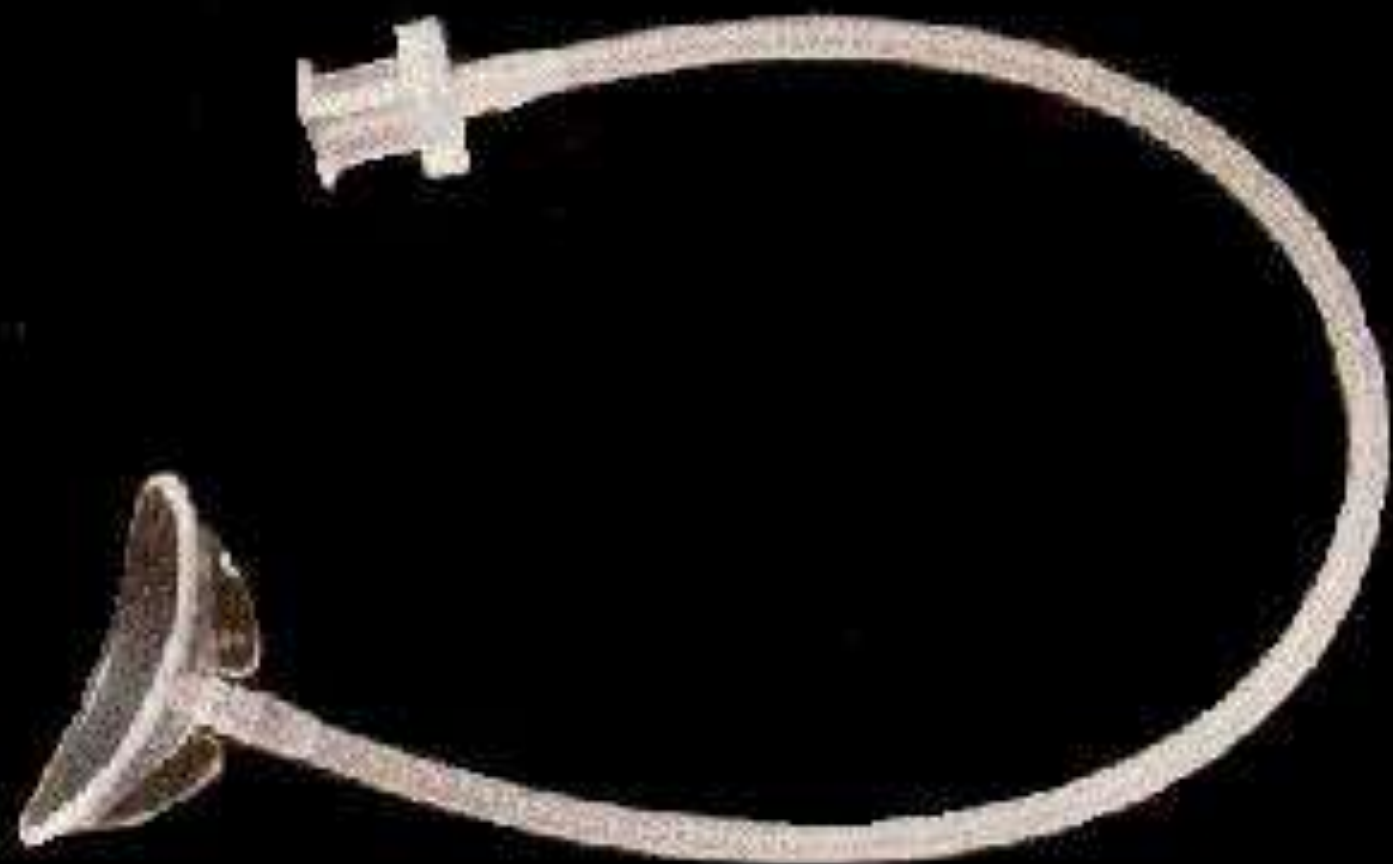
Acids

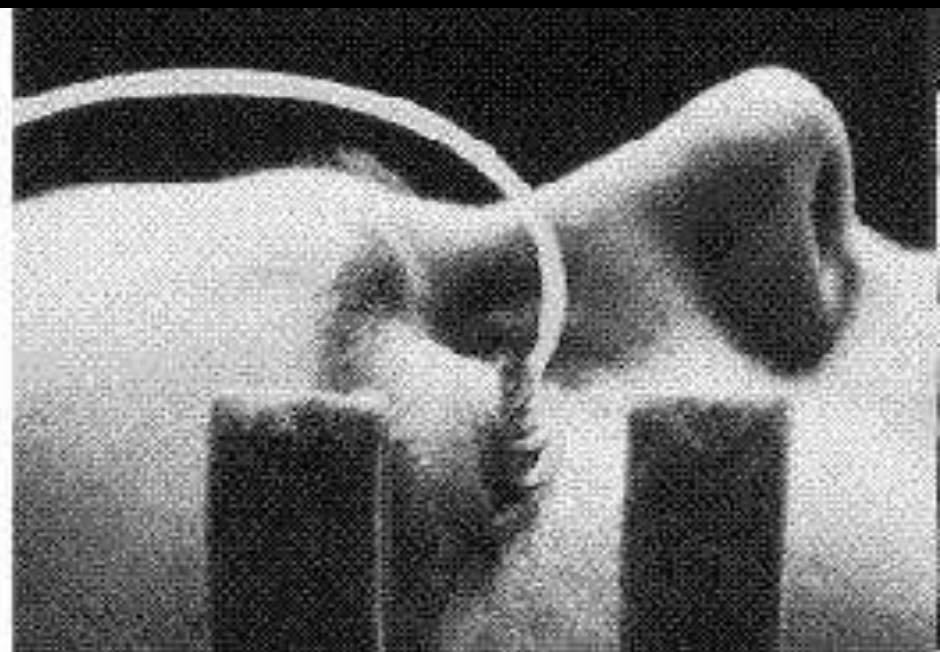
- Low pH
- Depth of penetration usually less due to precipitation of proteins

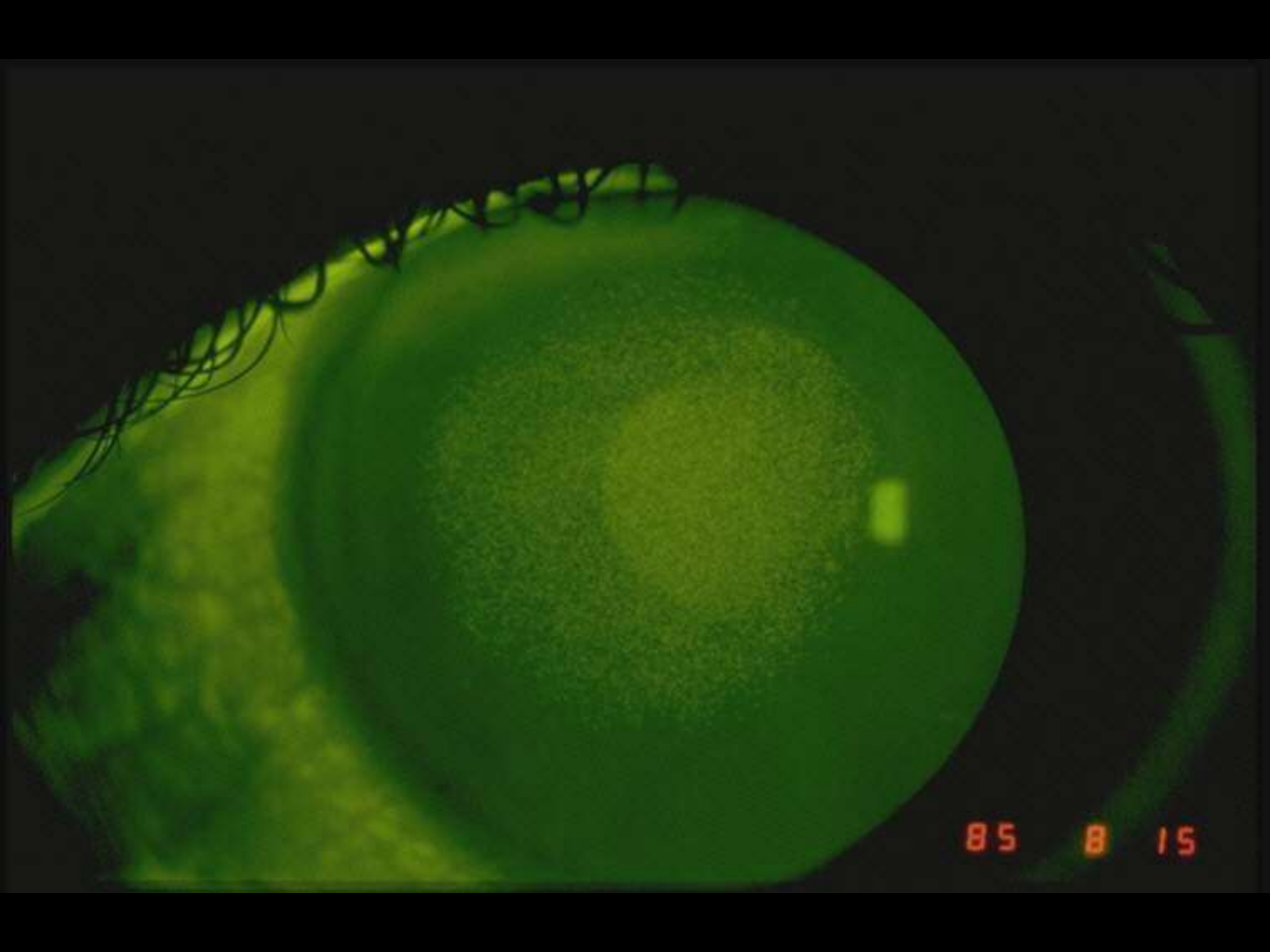
Chemical Burns – Initial Treatment

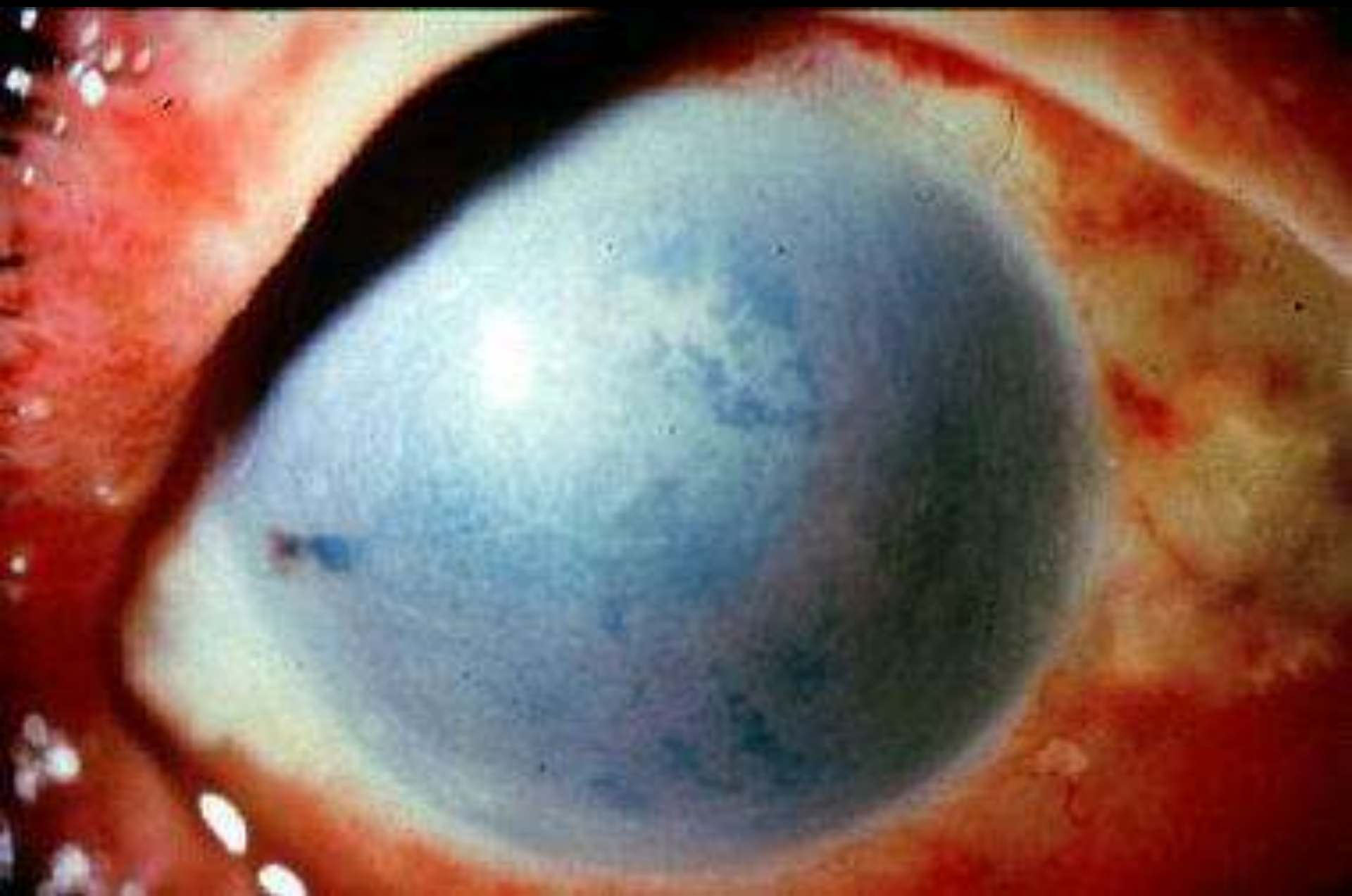
- Apply topical anesthesia
- Copious irrigation, preferably with saline or lactated Ringer's for at least 30 minutes
- May use Morgan lens or IV tubing
- Lid speculum may be helpful
- Check pH

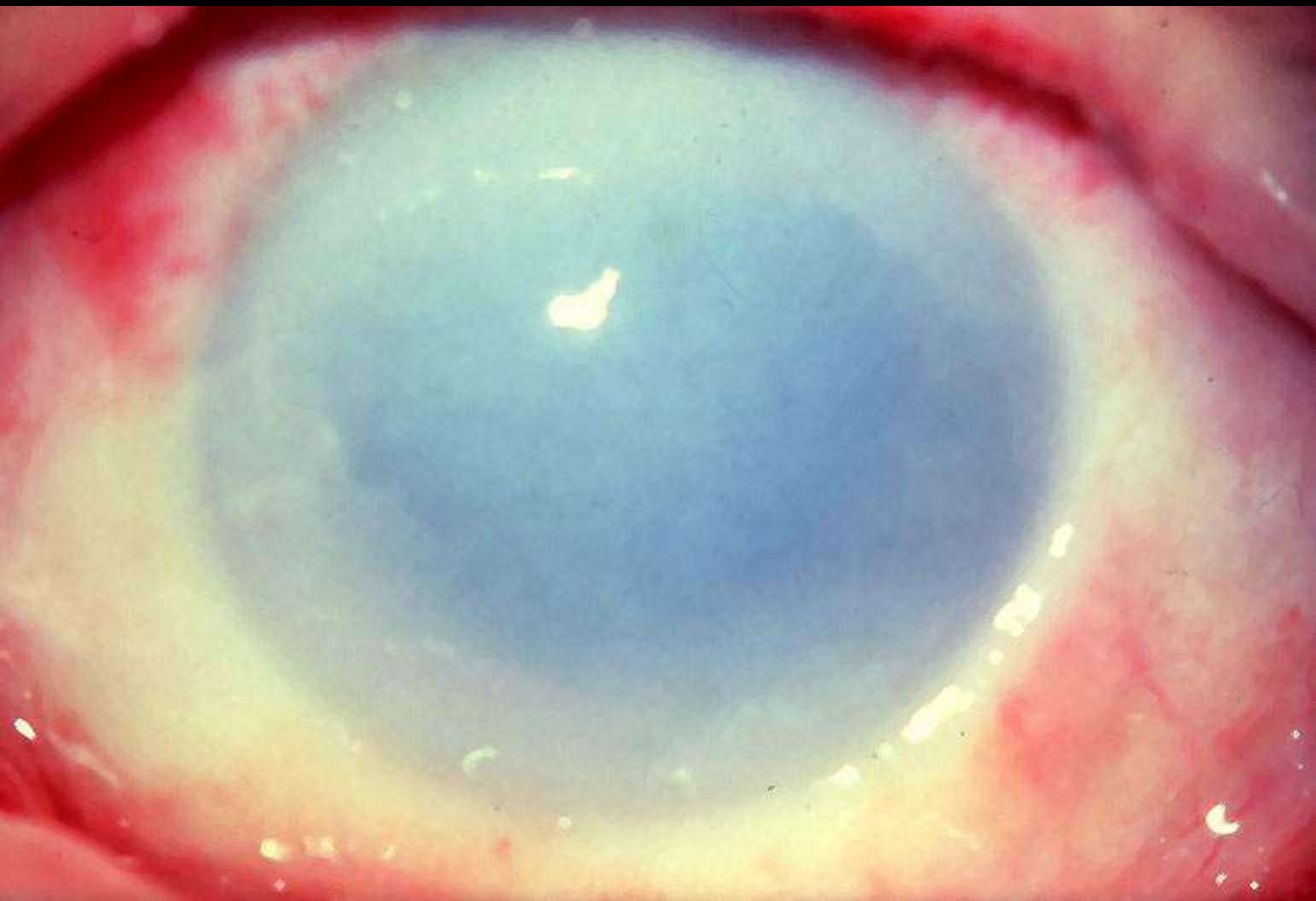






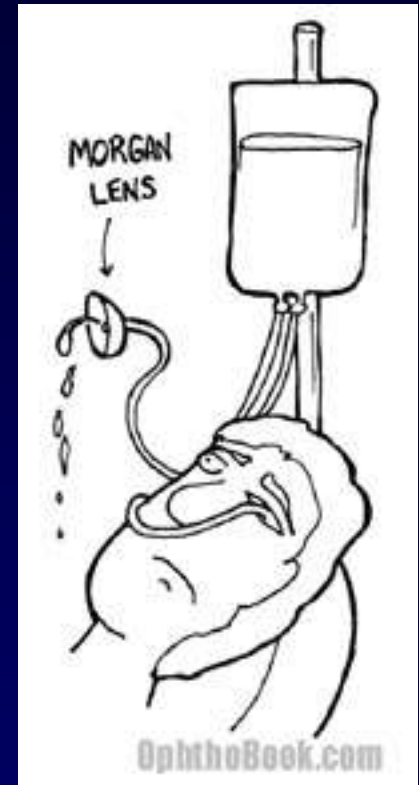






Chemical Burns - Treatment

- Careful examination
- Be sure to evert the eyelids
- Cyclogyl 1%
- Antibiotic ophthalmic ointment
- Pressure patch
- Oral pain meds
- Refer to ophthalmology



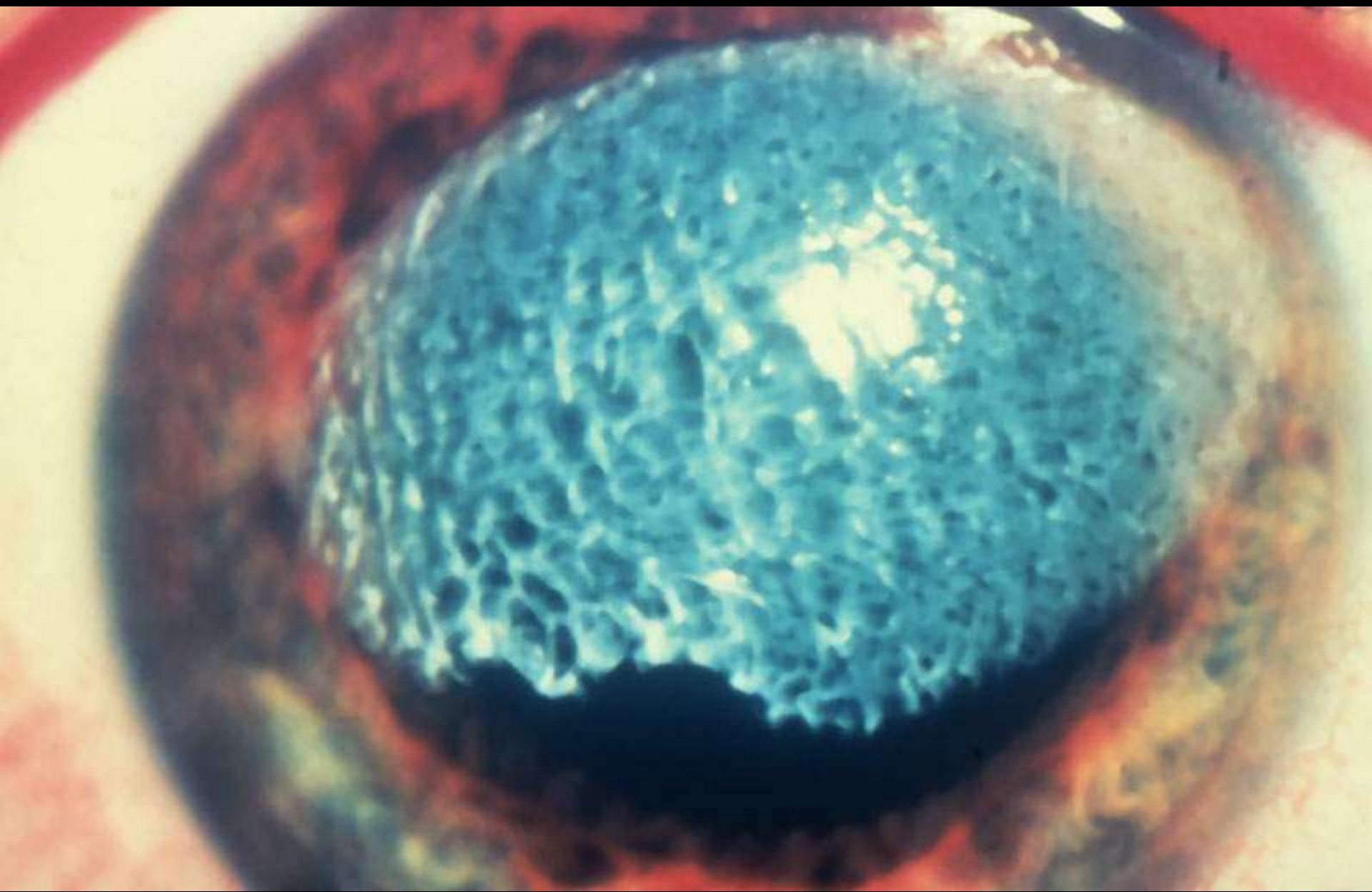
Irrigation First

Thermal Burn

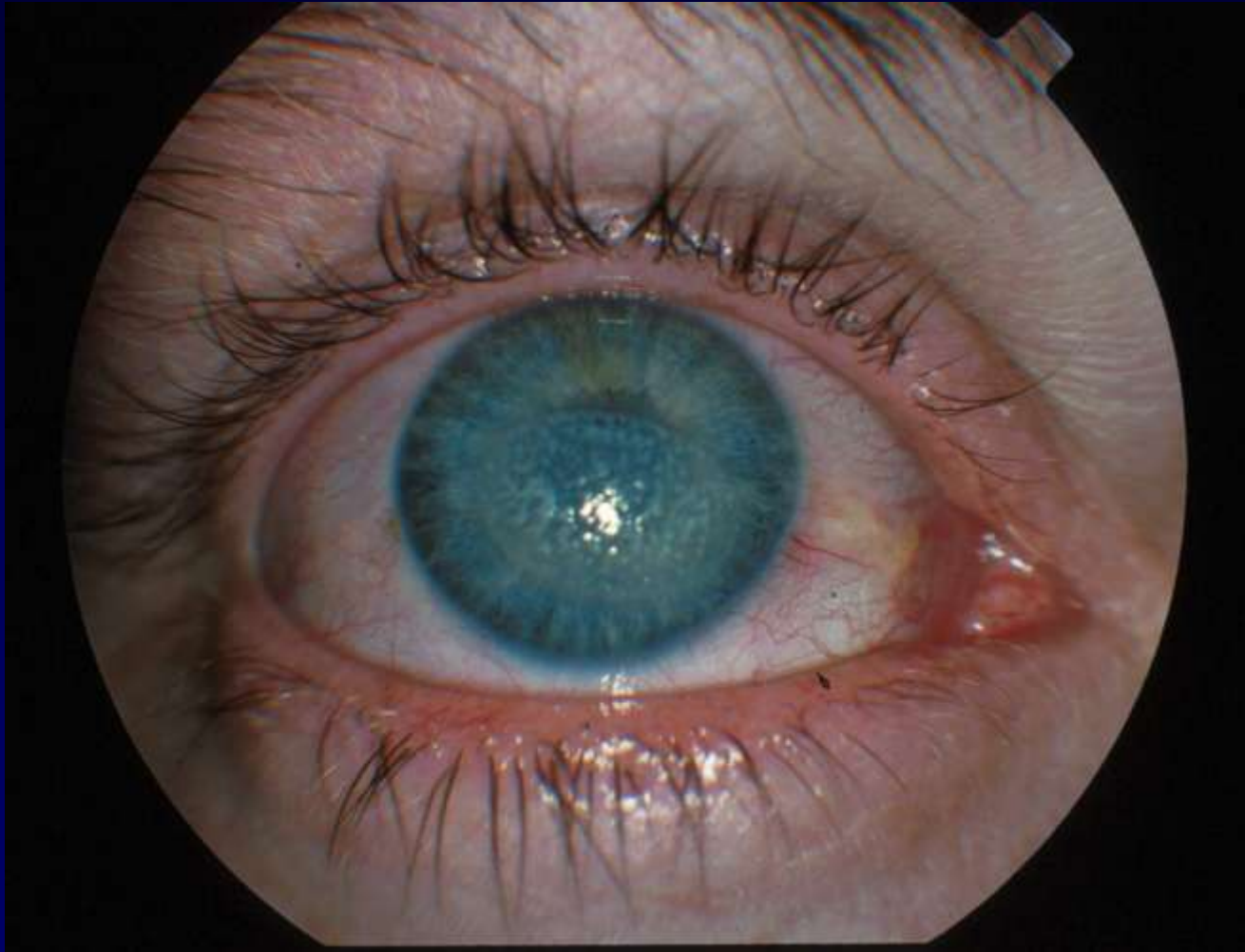
- Most common – cigarettes and curling iron
- Usually superficial burns
- Treat like chemical burn except no irrigation needed
- May need debridement of burned tissue







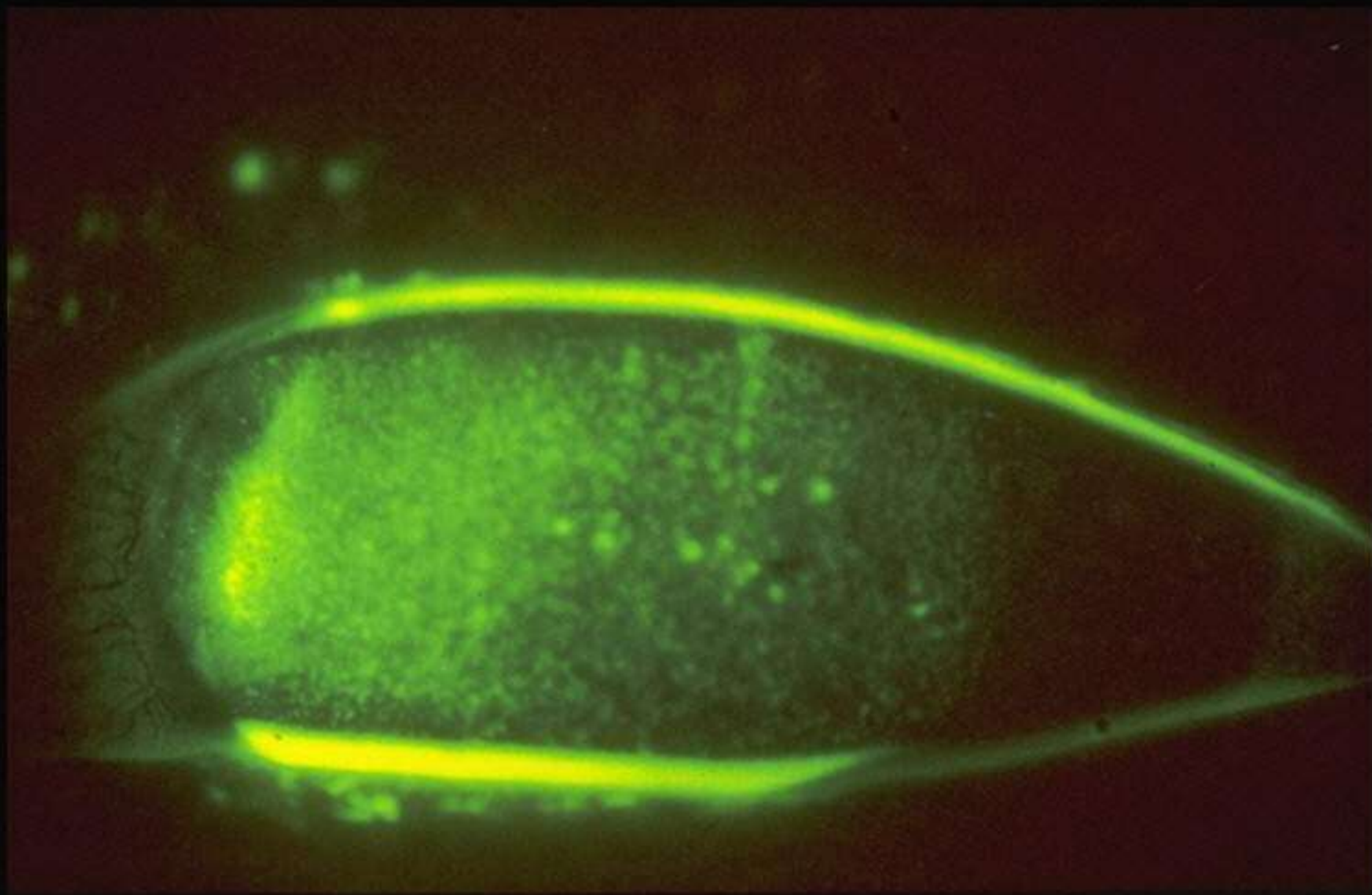
Thermal Corneal Burn



Ultraviolet Burn

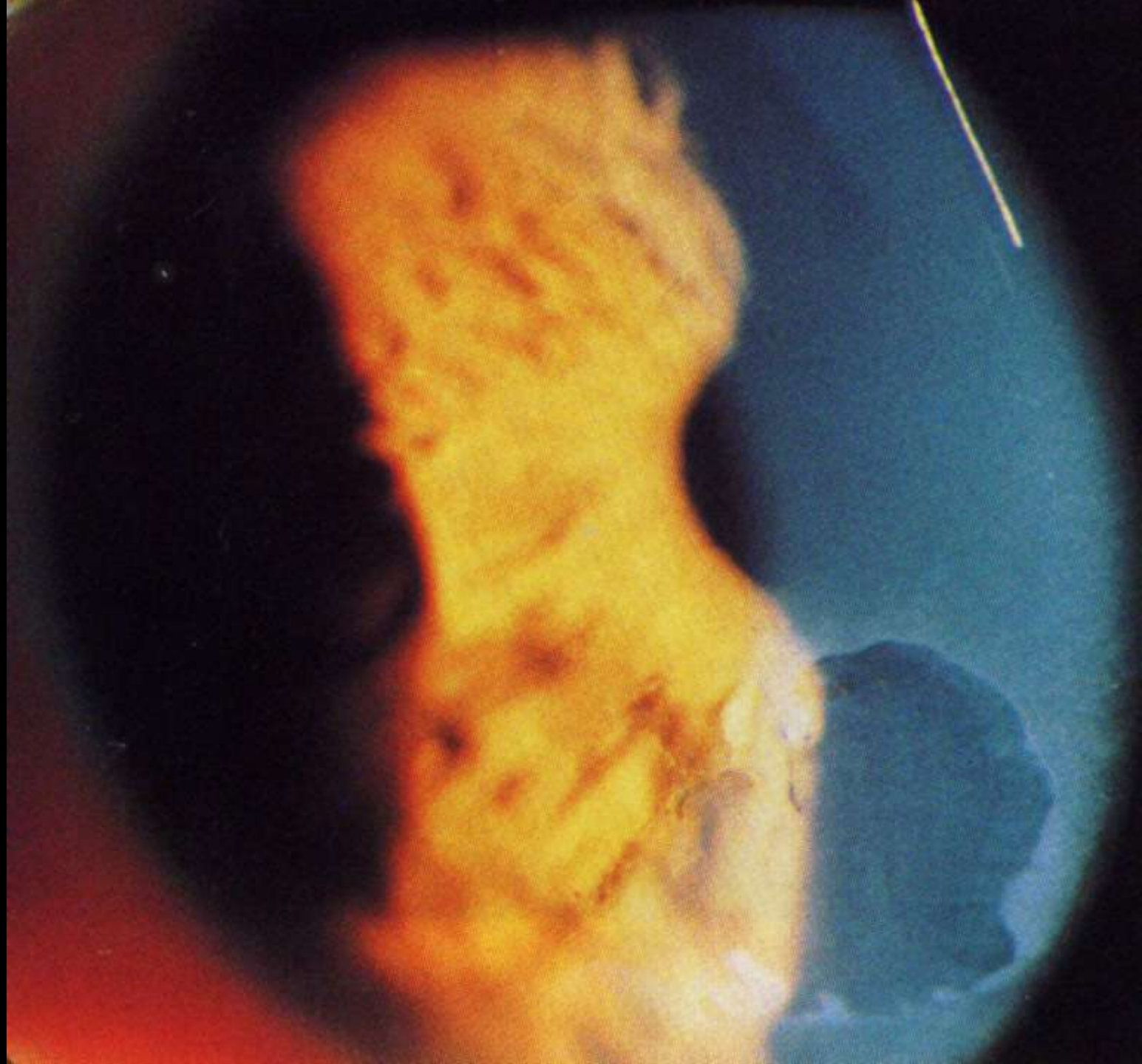


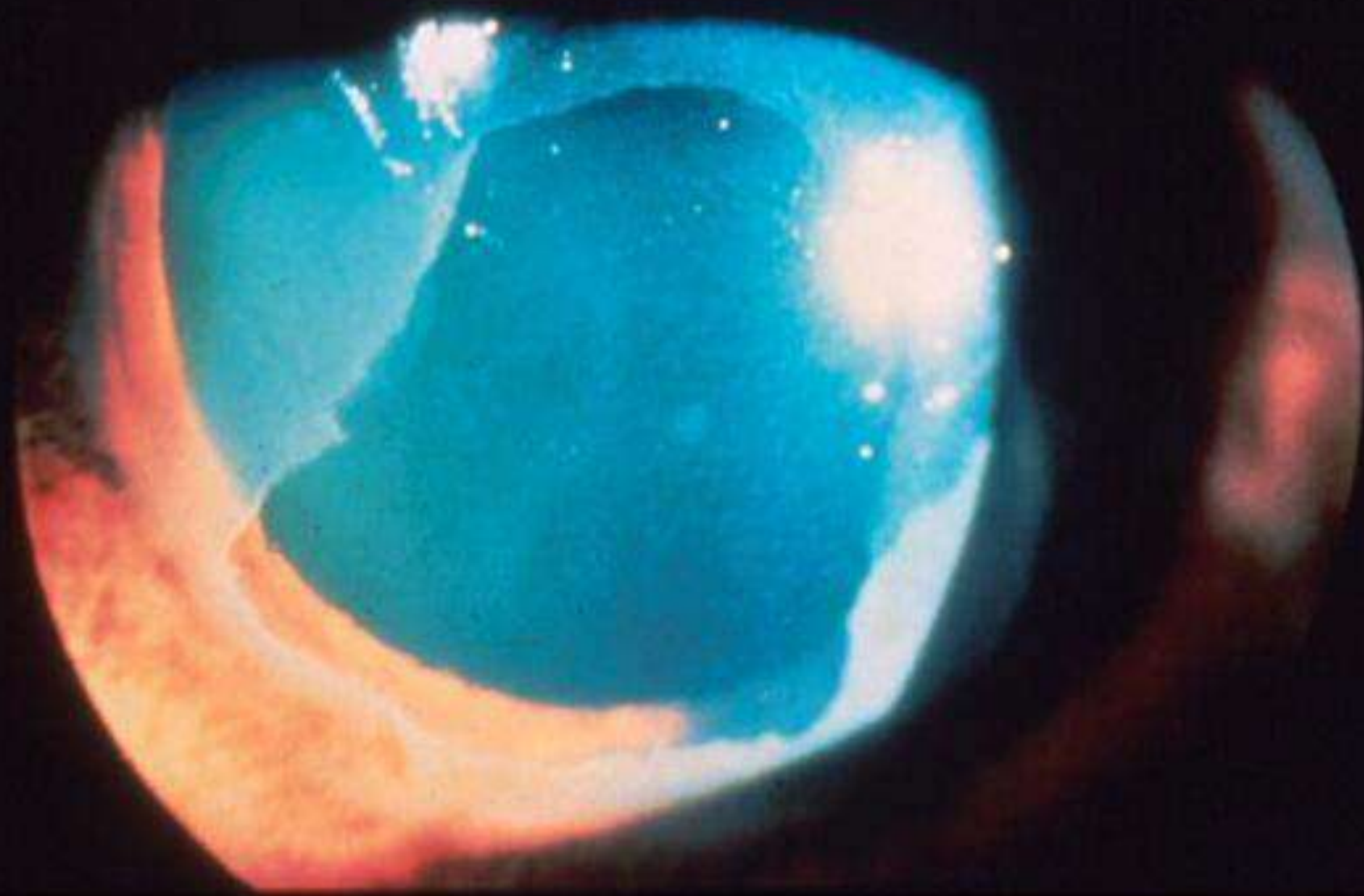
- Welding or sun lamps without eye protection
- Produces small, diffuse epithelial defects which **stain with fluorescein**
- Becomes severely painful several hours after exposure
- Treat with Cyclogyl, antibiotic ointment, and pressure patching

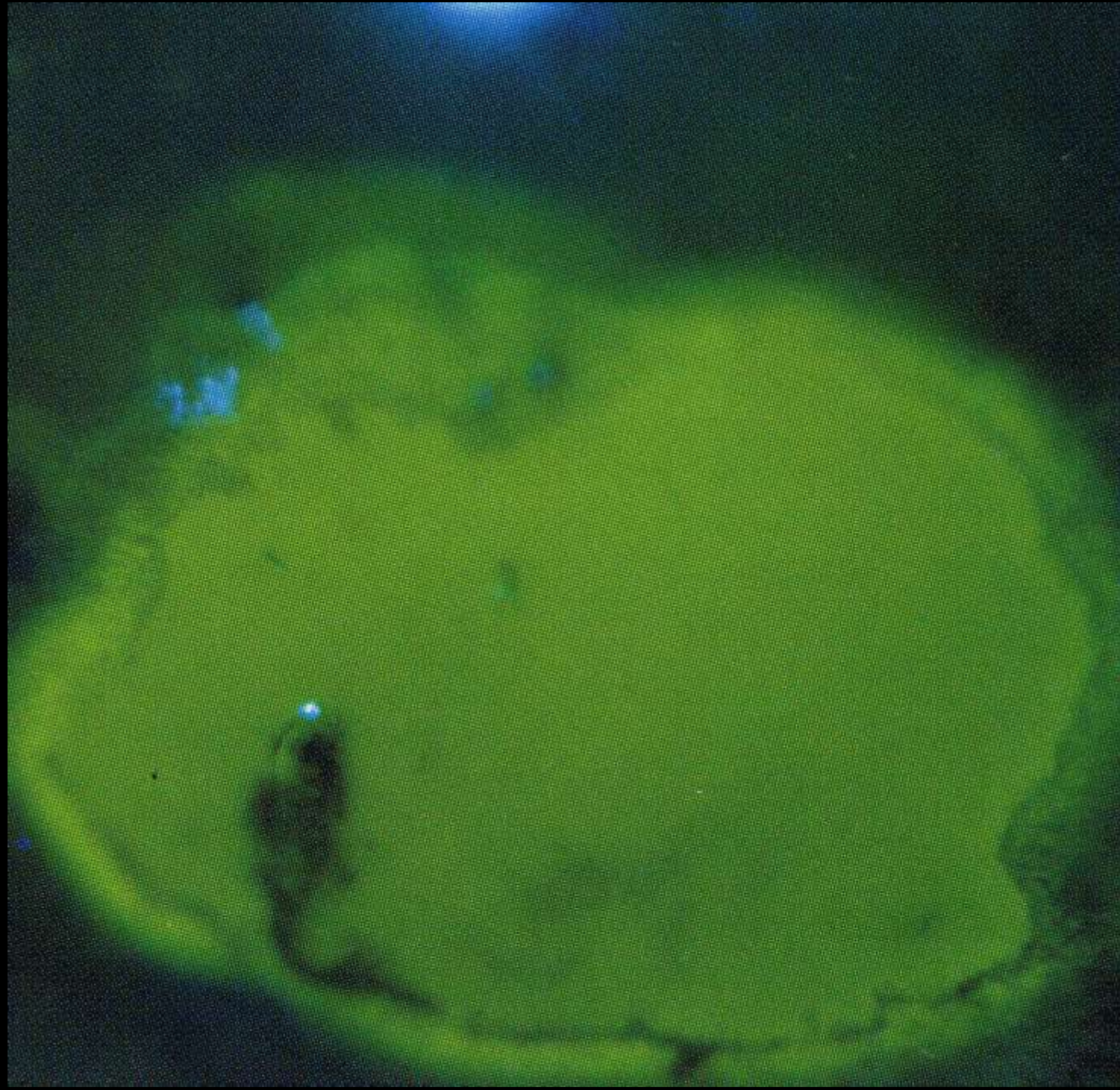


Corneal Abrasions

- Usually a defect in superficial layer of cornea
- Can usually be seen without fluorescein
- Glows yellow/green with fluorescein and blue light
- Treat with Cyclogyl (dilating drop), antibiotic ointment or drops, and possibly pressure patch. Needs follow up exam
- NEVER prescribe topical anesthetic







Corneal Abrasions

- Non-CTL Wearer
 - Antibiotic ointment/drop (e.g. Emycin/polytrim)
 - Cycloplegic (cyclogyl bid)
 - May consider Pressure Patch (as long as not due to false fingernails or possibility of vegetable matter)
- CTL Wearer (Requires anti-pseudomonal coverage)
 - e.g. Ciloxan, Vigamox, Zymar q2-4hr
 - Cycloplegic
 - **DO NOT PATCH**
 - NO contact lens wear

Corneal Abrasions

- Follow-up – Refer to Ophthalmology
 - 24 hrs if patched
 - Large/central abrasion – Daily
 - Peripheral/small abrasion – 2-3d
 - CTL wearer—daily (once healed, NO CTL wear for 1 week)

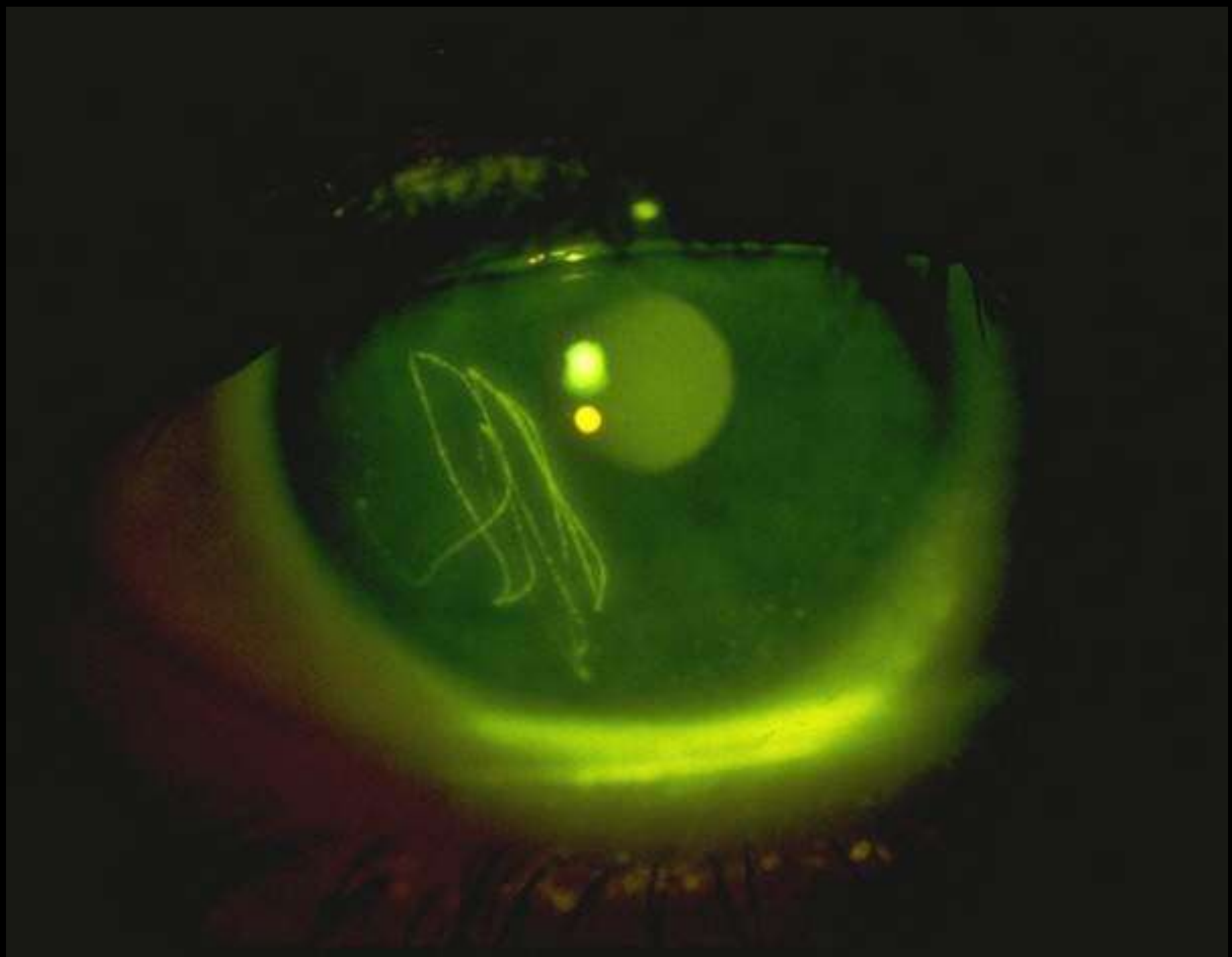
Superficial Foreign Body

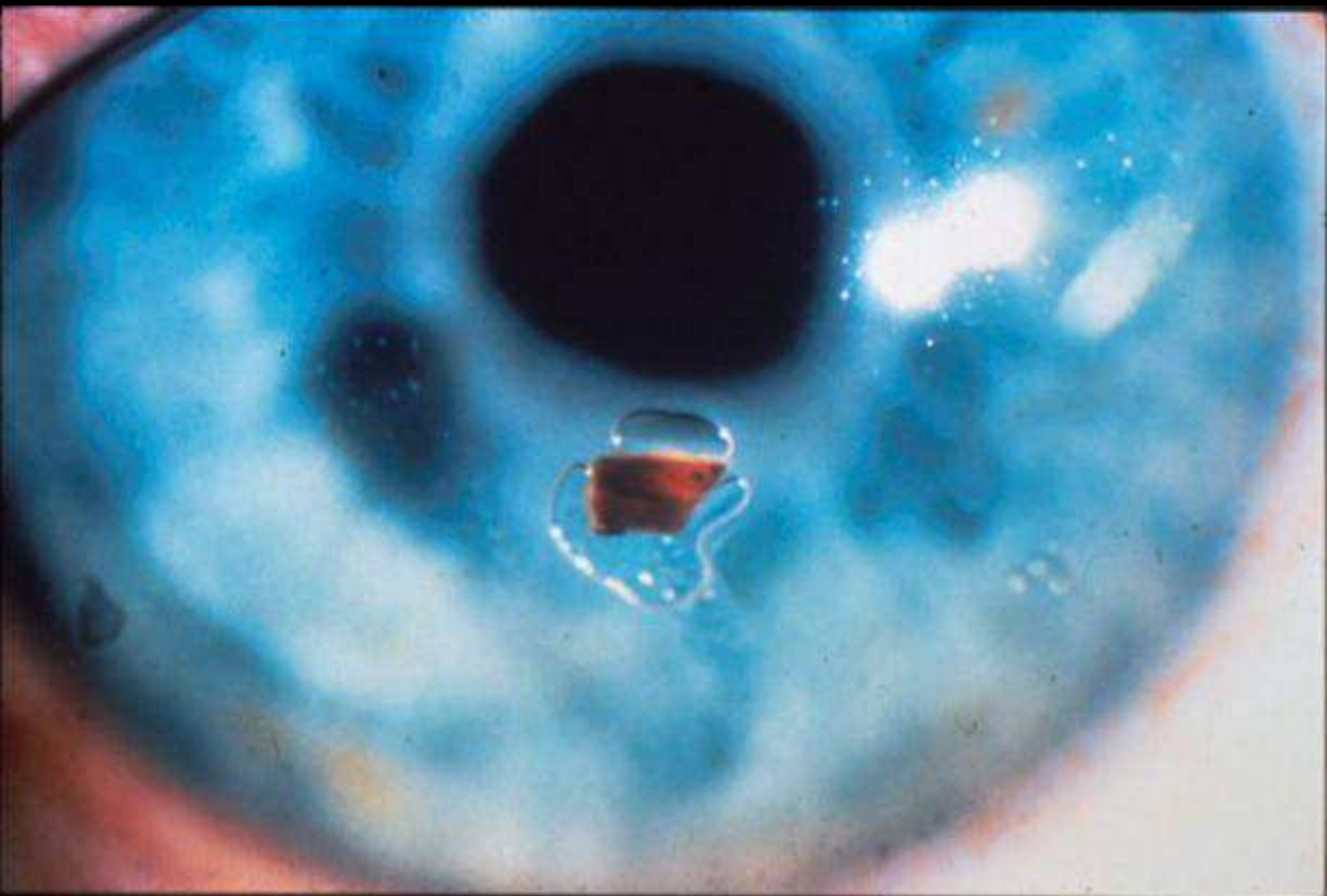
- Multiple linear epithelial defects suggests foreign body beneath the eyelid
- Be sure to flip upper eyelid with cotton-tip
- Can be removed if superficial with moist cotton-tip
- If embedded -- can be removed with cotton-tip or 25-gauge needle
 - however would consult ophthalmologist prior to removal

Key Point: Evert the Eyelids

Evert the Eyelids









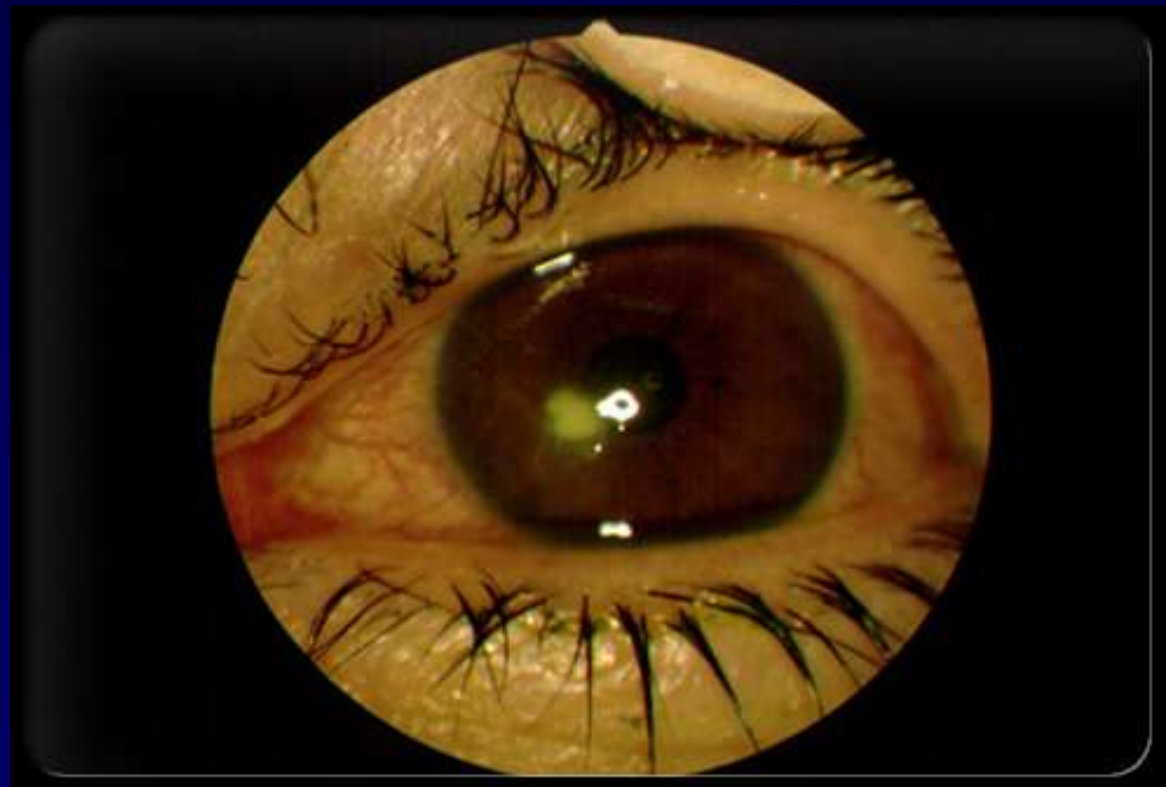
Metallic FB with Rust Ring



Corneal Ulcer

- Trauma
- Contact Lens Wear
- Exposure

Refer to
Ophthalmologist
for immediate
cultures and
antibiotic
treatment



Intraorbital/Intraocular Foreign Body

- High-speed projectile foreign body to eye or orbit
- Clinical Scenarios:
 - Weedeating or mowing
 - Grinding metal
 - Hammering or pounding metal
 - Motor vehicle accident



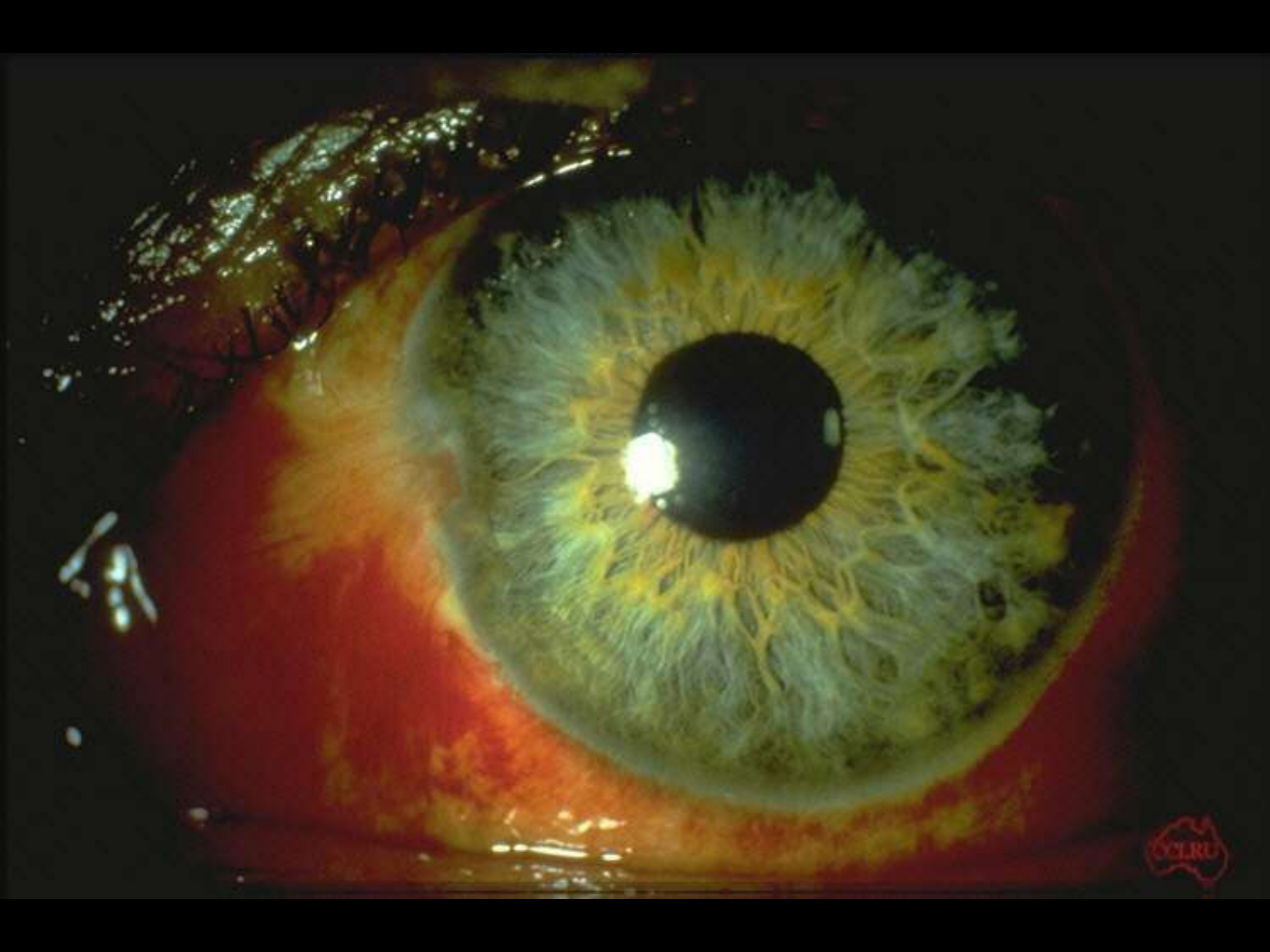
Intraorbital/Intraocular Foreign Body

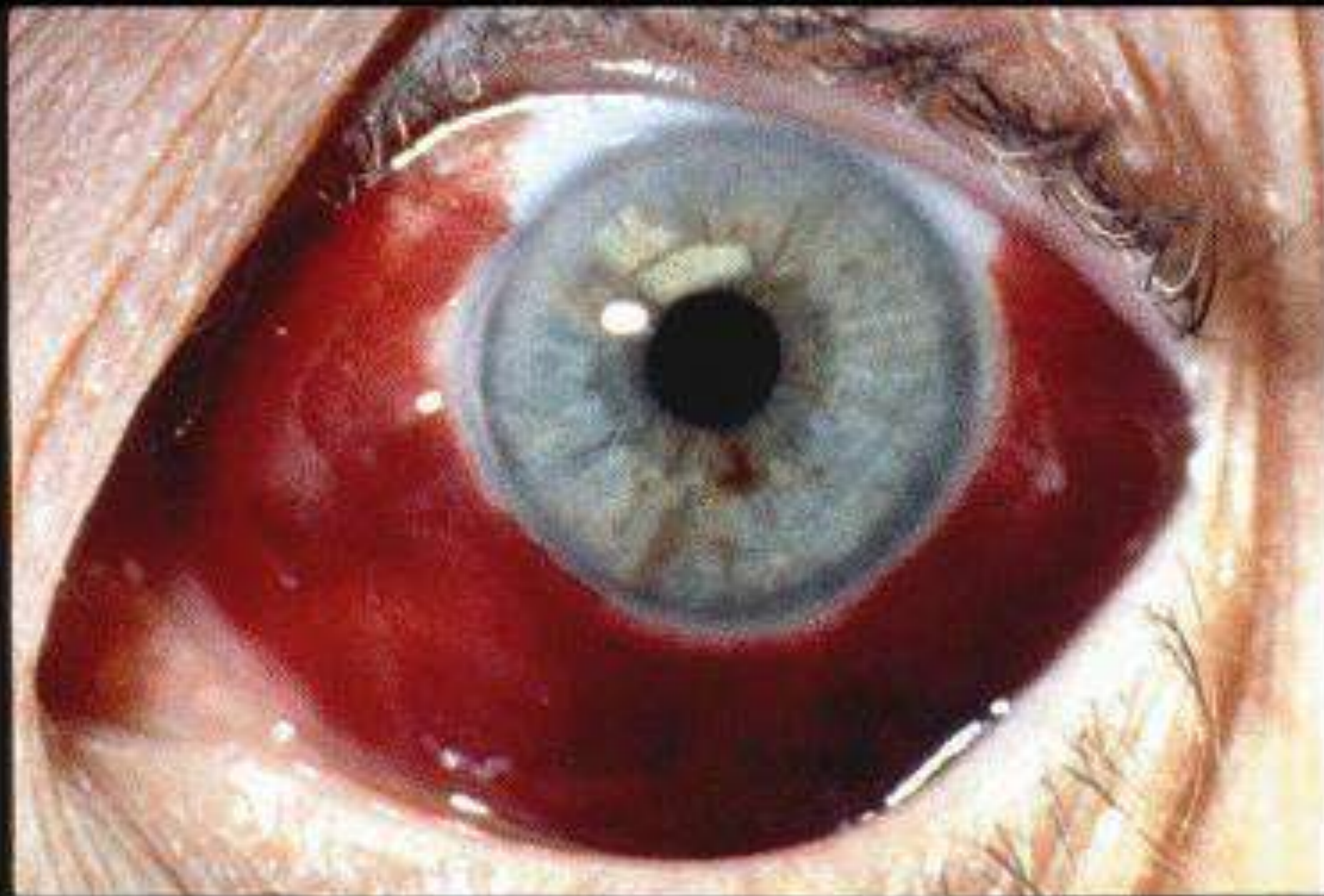


- Refer to Ophthalmology for complete examination
- Need to rule out injury to globe or intraocular FB -- requires surgery
- CT scan orbits (1mm cuts, Axial & Coronal)

Subconjunctival Hemorrhage

- Very common after blunt trauma
- Superficial blood vessels broken
- May occur spontaneously (Coumadin, aspirin,Valsalva)
- Usually self-limited
- Treat with artificial tears and reassurance
- May be suggestive of ruptured globe

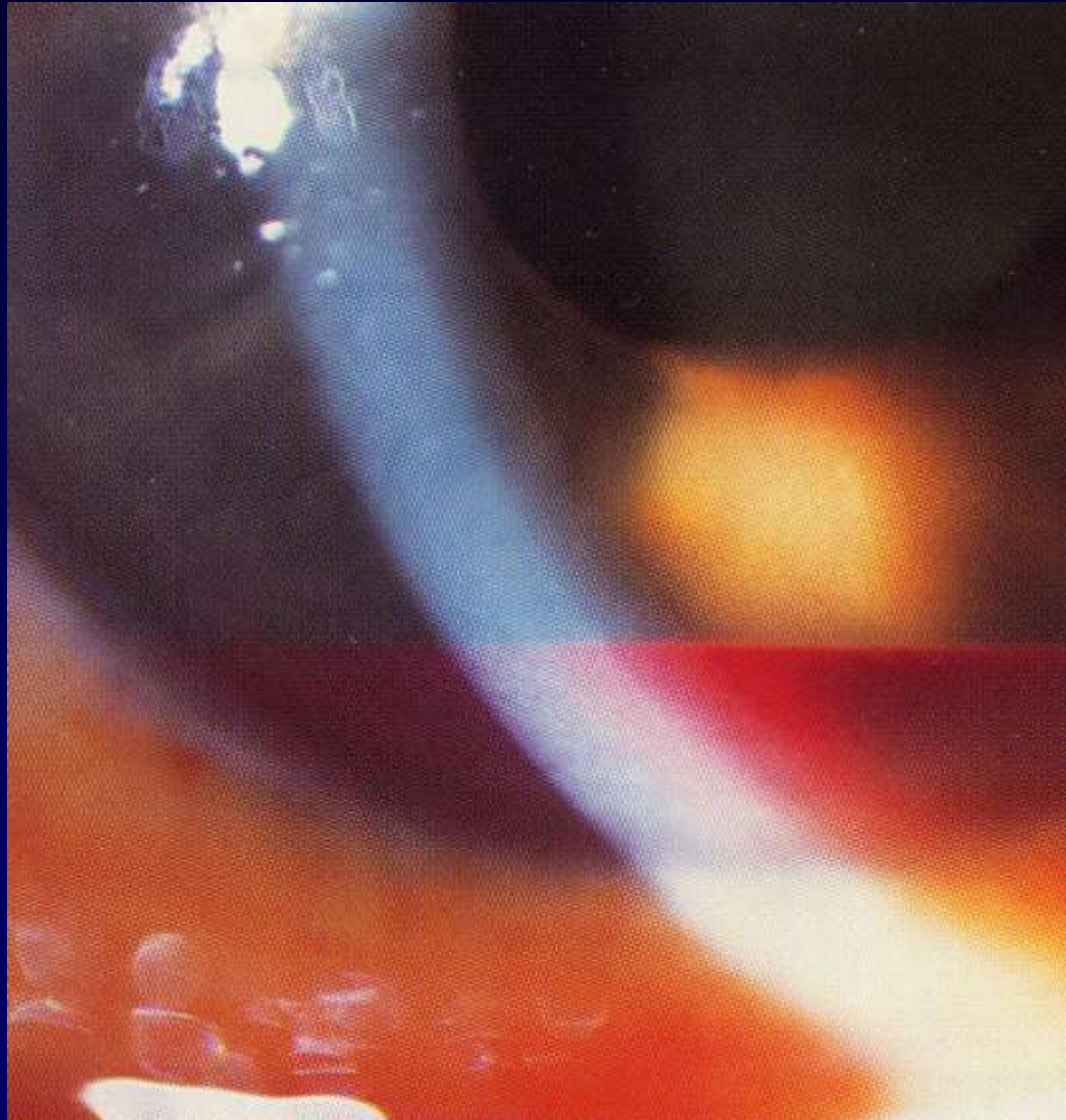




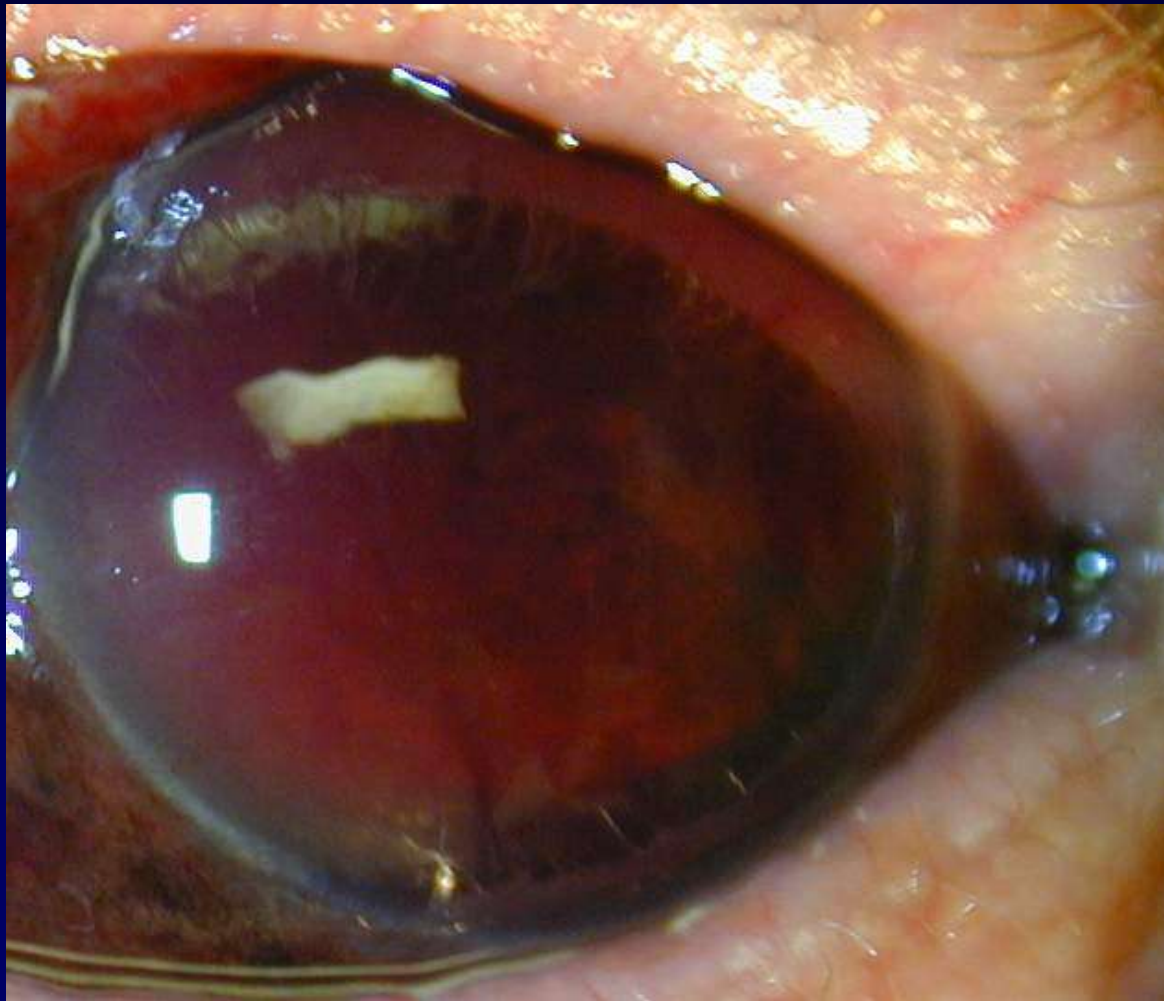
Hyphema

- **Blood in the anterior chamber** (posterior to cornea and anterior to lens)
- Can be diffuse or layered
- Will require very careful ocular examination by ophthalmologist including ruling out ruptured/lacerated globe
- **Place metal shield over eye and refer to ophthalmologist for further examination**
- Need to know Sickle Cell status

Hyphema



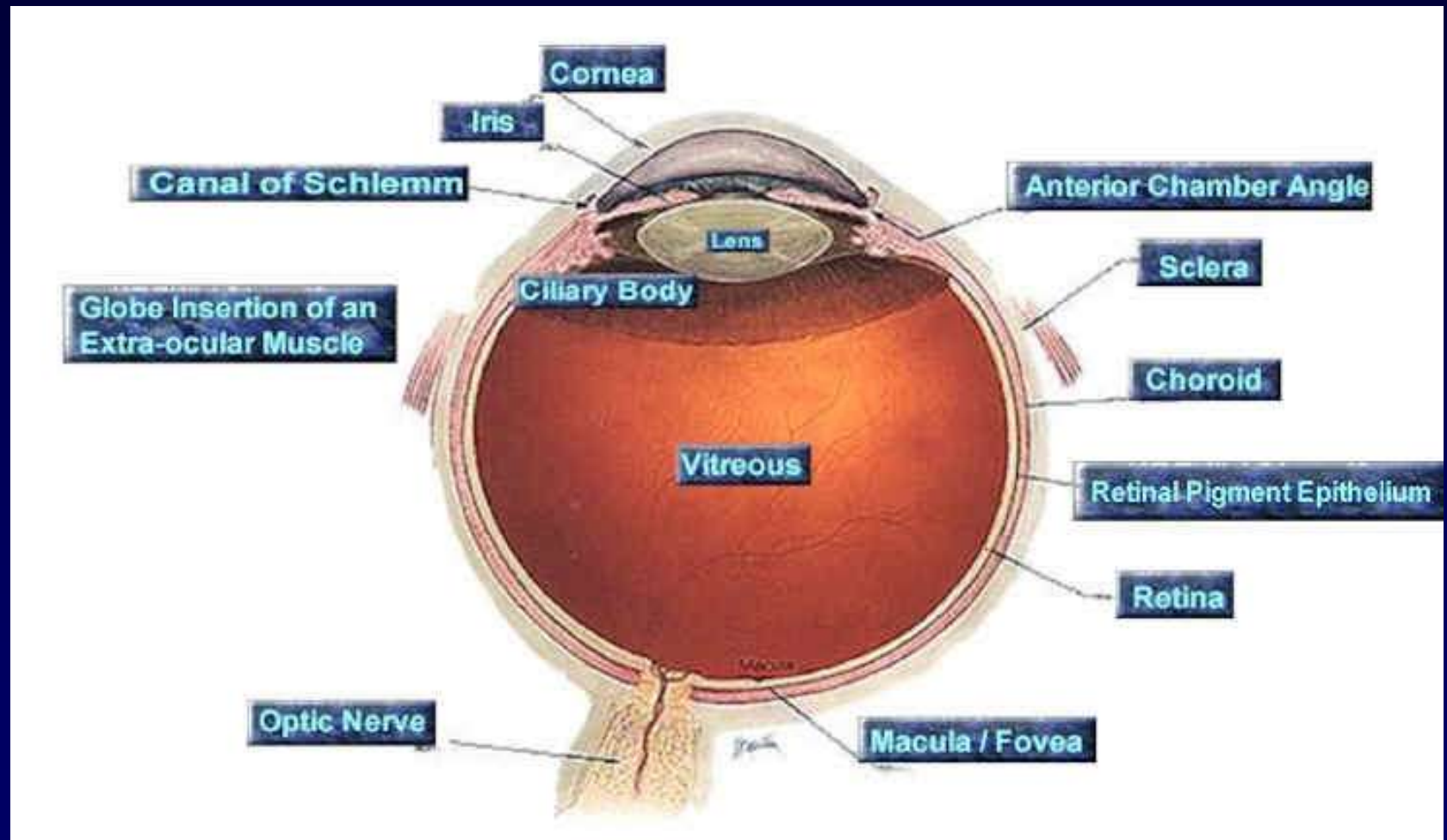
Hyphema



Bloody Chemosis



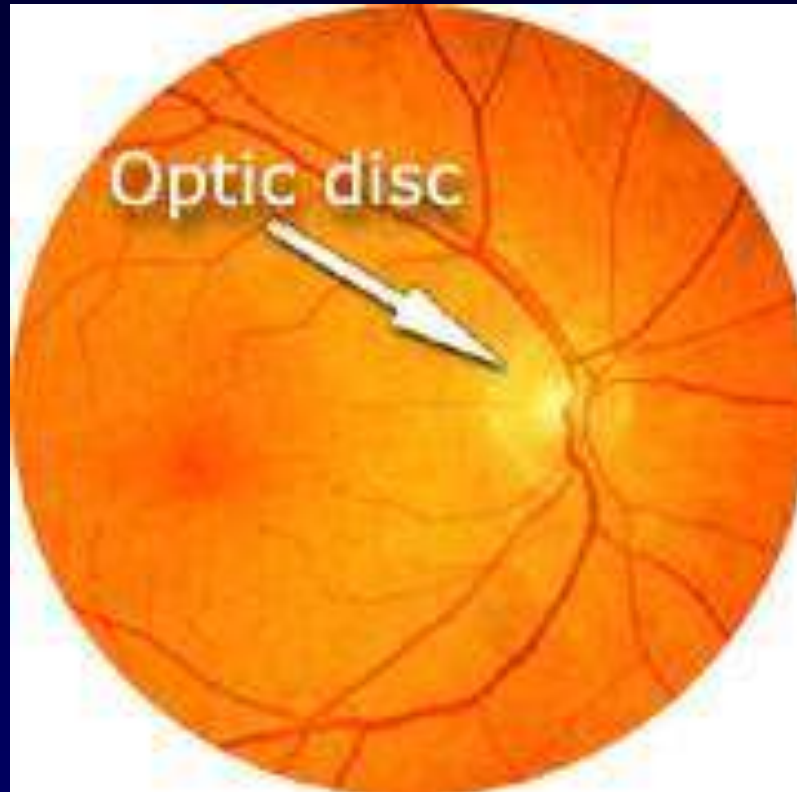
RETINAL & OPTIC NERVE EMERGENCIES



Optic Neuritis

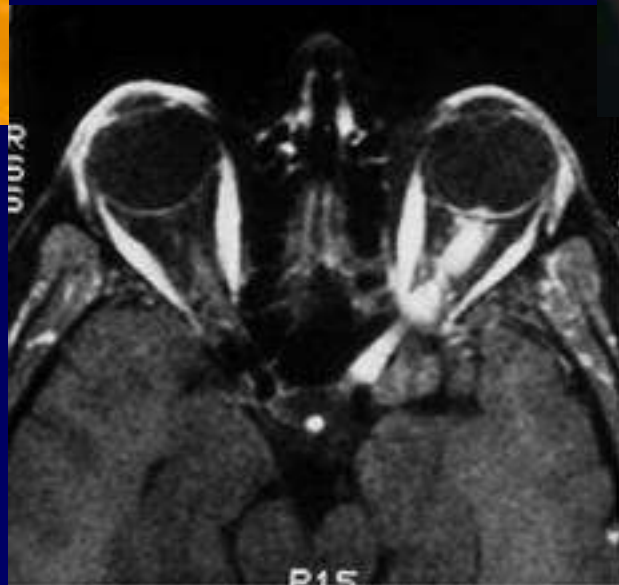
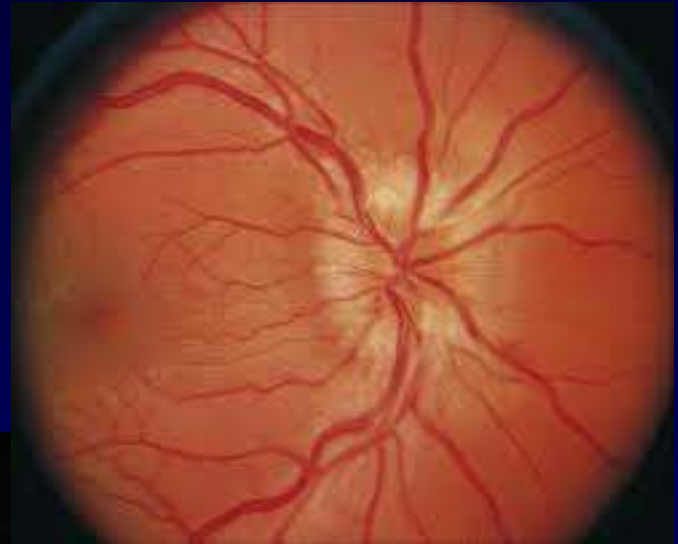
- Inflammation of the optic nerve in young adults
- Symptoms: unilateral loss of vision over hours to days. Orbital pain with eye movement, acquired loss of color vision, reduced perception of light
- Signs: Relative afferent pupillary defect, decreased color, central, visual field defects, swollen or normal optic disc
- Tx: Ophthalmologic referral – will require MRI and possibly IV steroids
- Can be a risk for multiple sclerosis

Optic neuritis

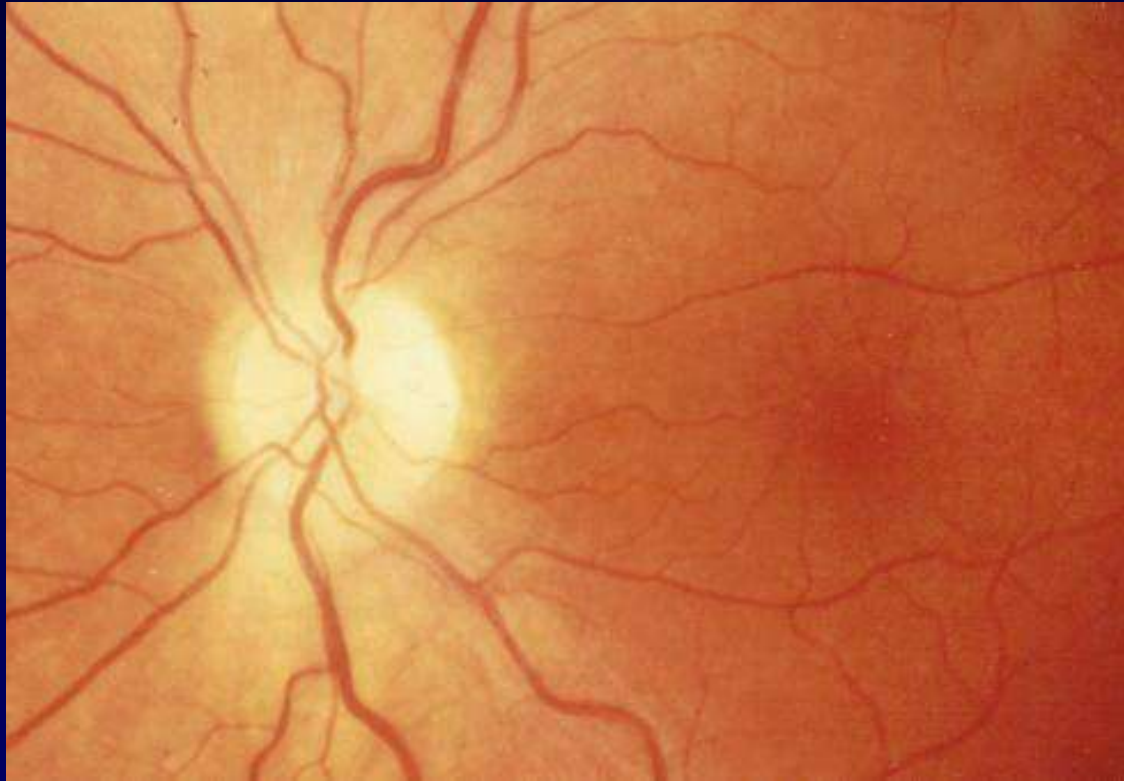


Normal optic nerve

Optic Neuritis



Optic neuritis

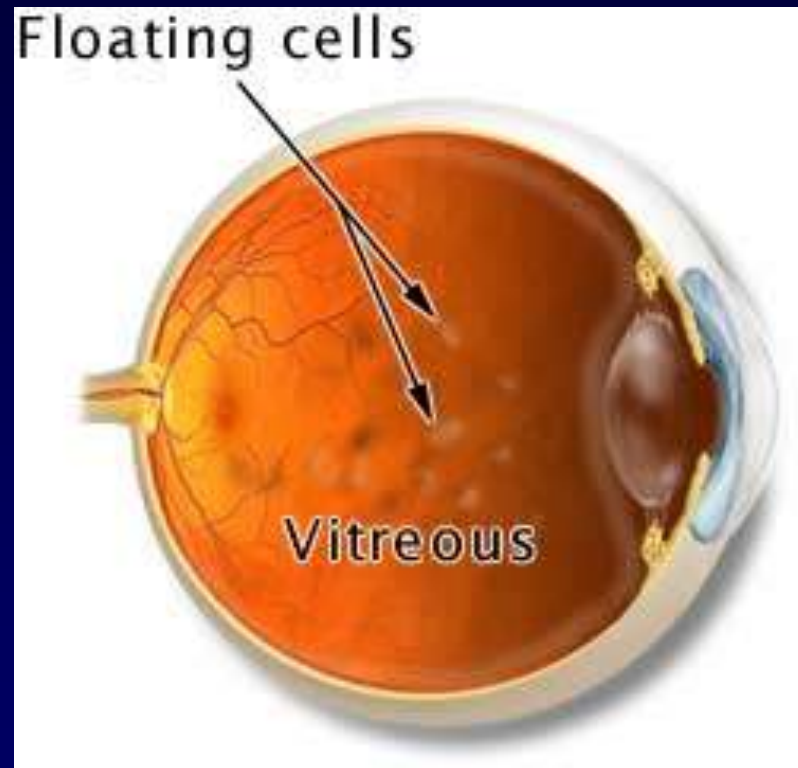


Pale optic nerve (after optic neuritis)

Floaters/Photopsia

- Floaters and photopsias (flashes of light) can represent normal aging process or other pathologies.
- Normal:
 - Floaters in the vitreous as it becomes more liquid as we age. Can cause posterior vitreous detachment (benign by itself but can lead to retinal tear and retinal detachment)
- Abnormal:
 - Posterior vitreous detachment leading to **retinal tear** and **possible retinal detachment**

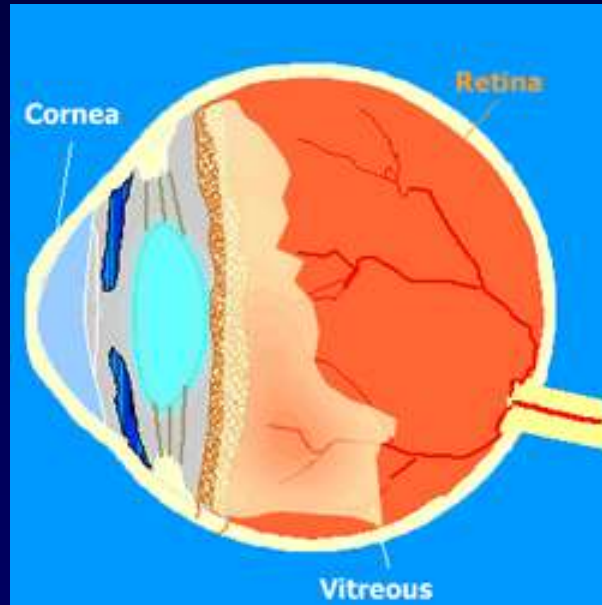
Floaters



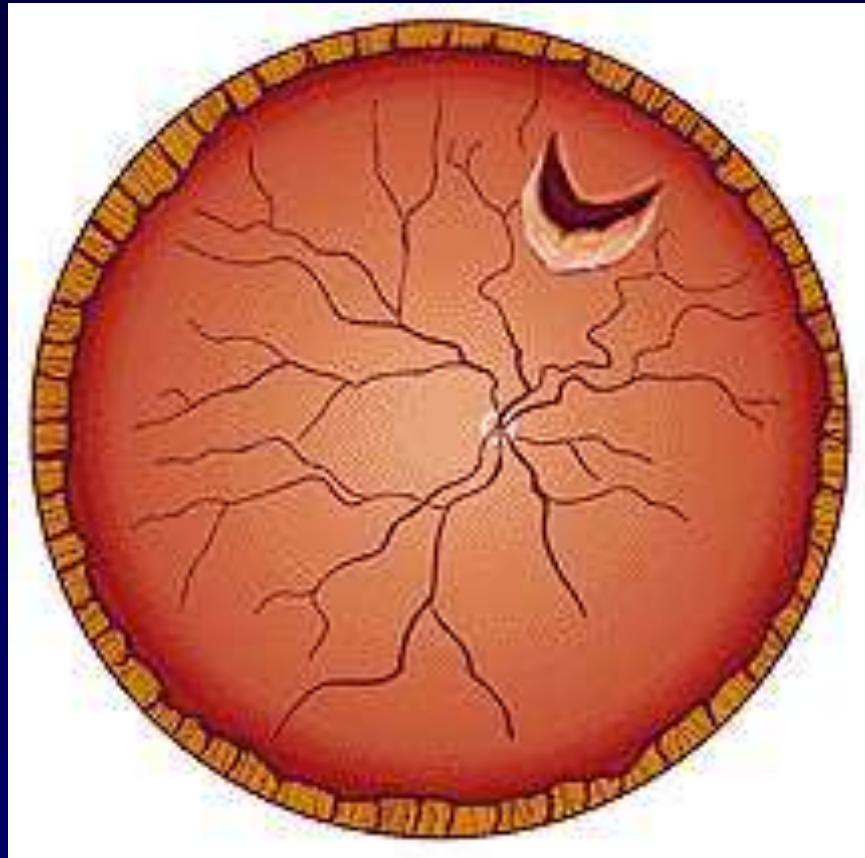
Posterior Vitreous Detachment



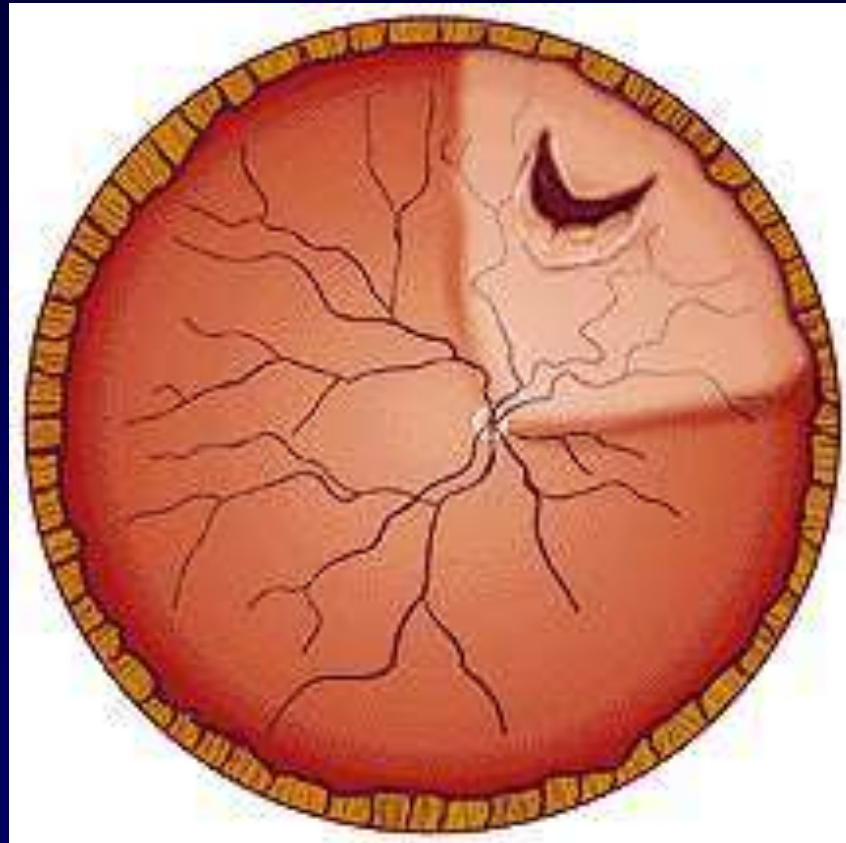
Retinal Tear



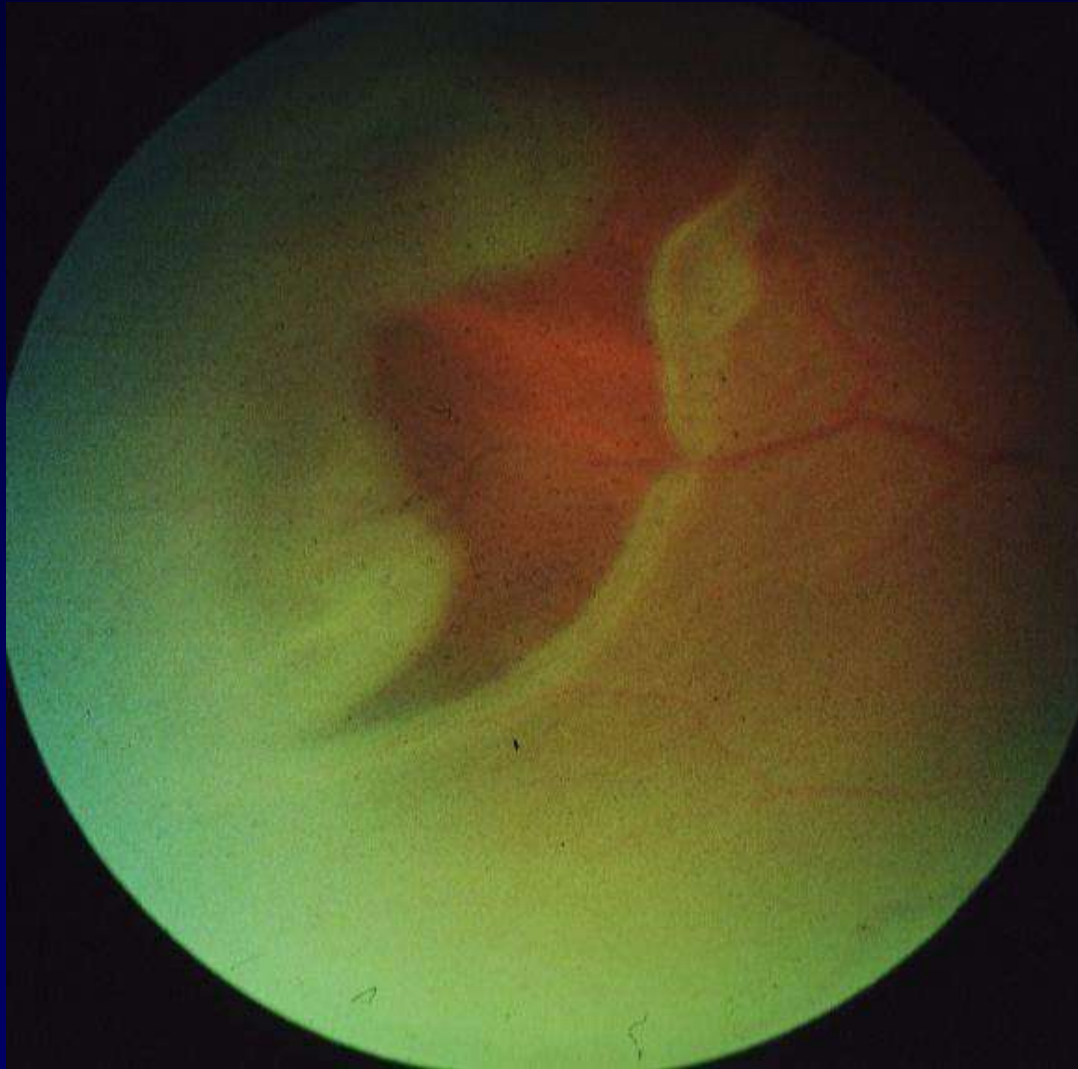
Retinal Tear



Retinal Tear w/ Detachment



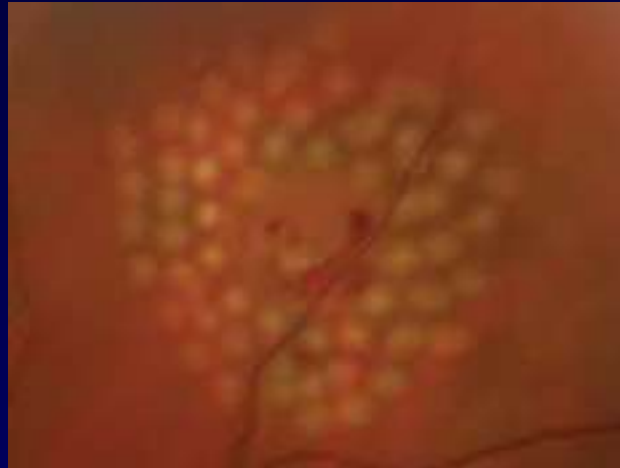
Retinal Tear



Retinal Tear



Retinal Tear Treatment

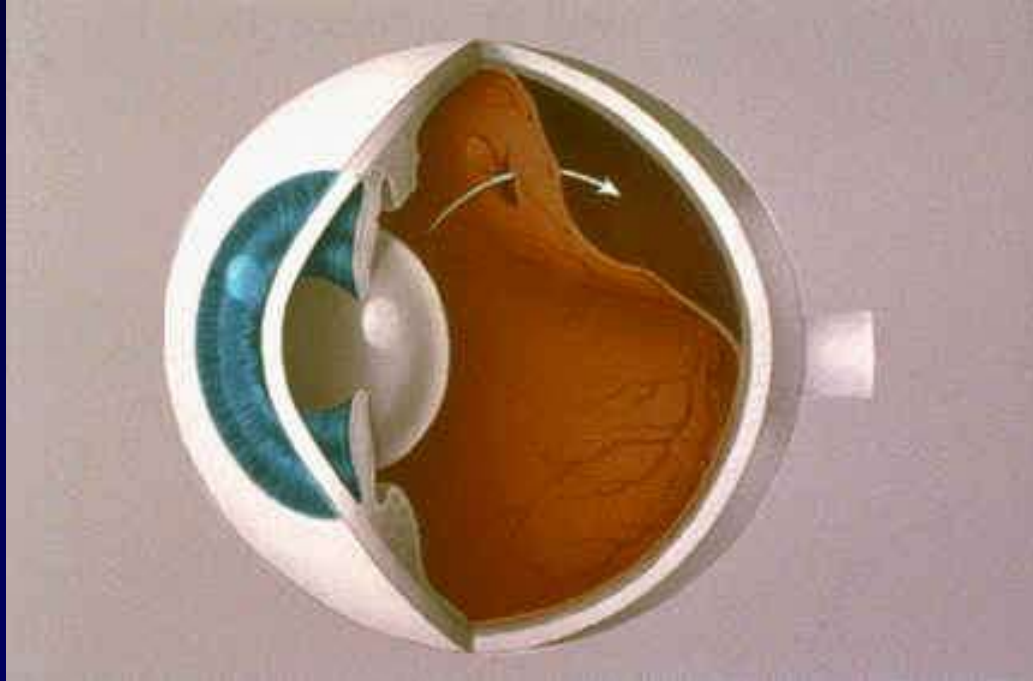


S/p Laser Retinopexy

Retinal Detachment

- Symptoms
 - Sudden onset of new floaters or flashes of light in one eye
 - **Dark curtain** “moving over vision”
 - Blurred images in particular visual field in one eye
- Painless
- Increased risk in myopic patients (near sighted), patients with recent trauma.

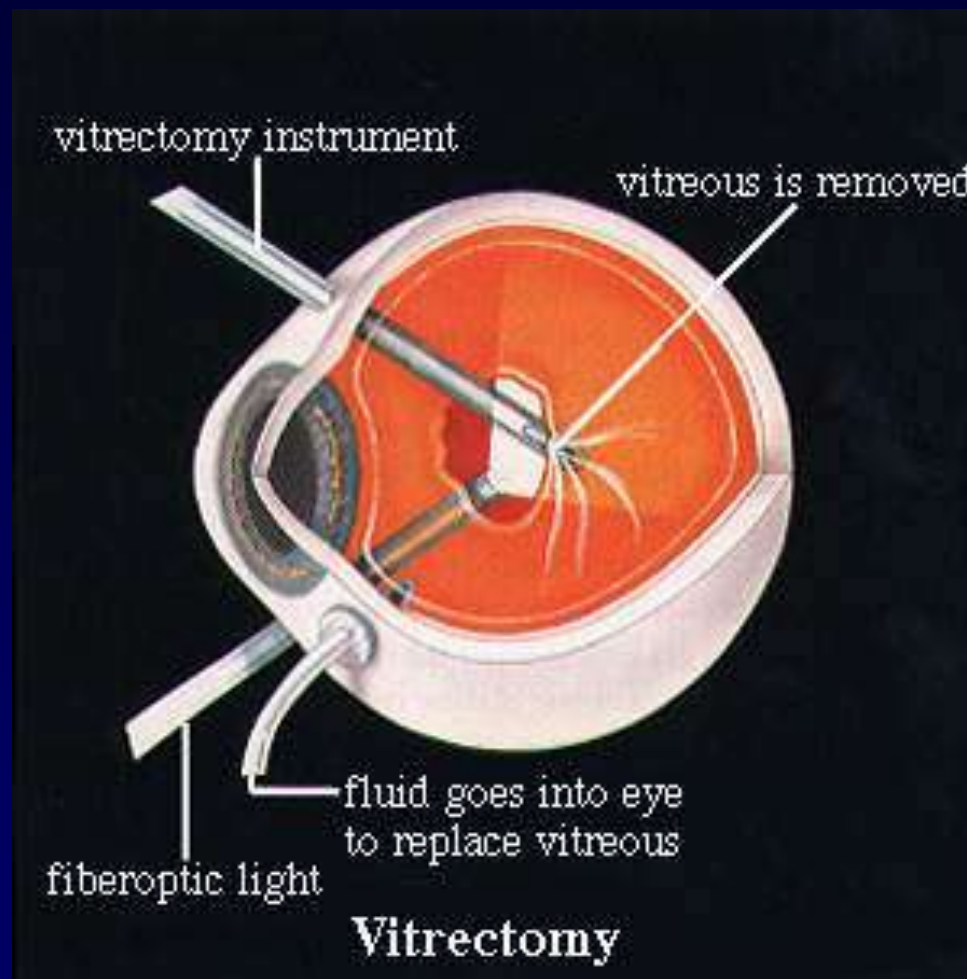
Retinal Detachment



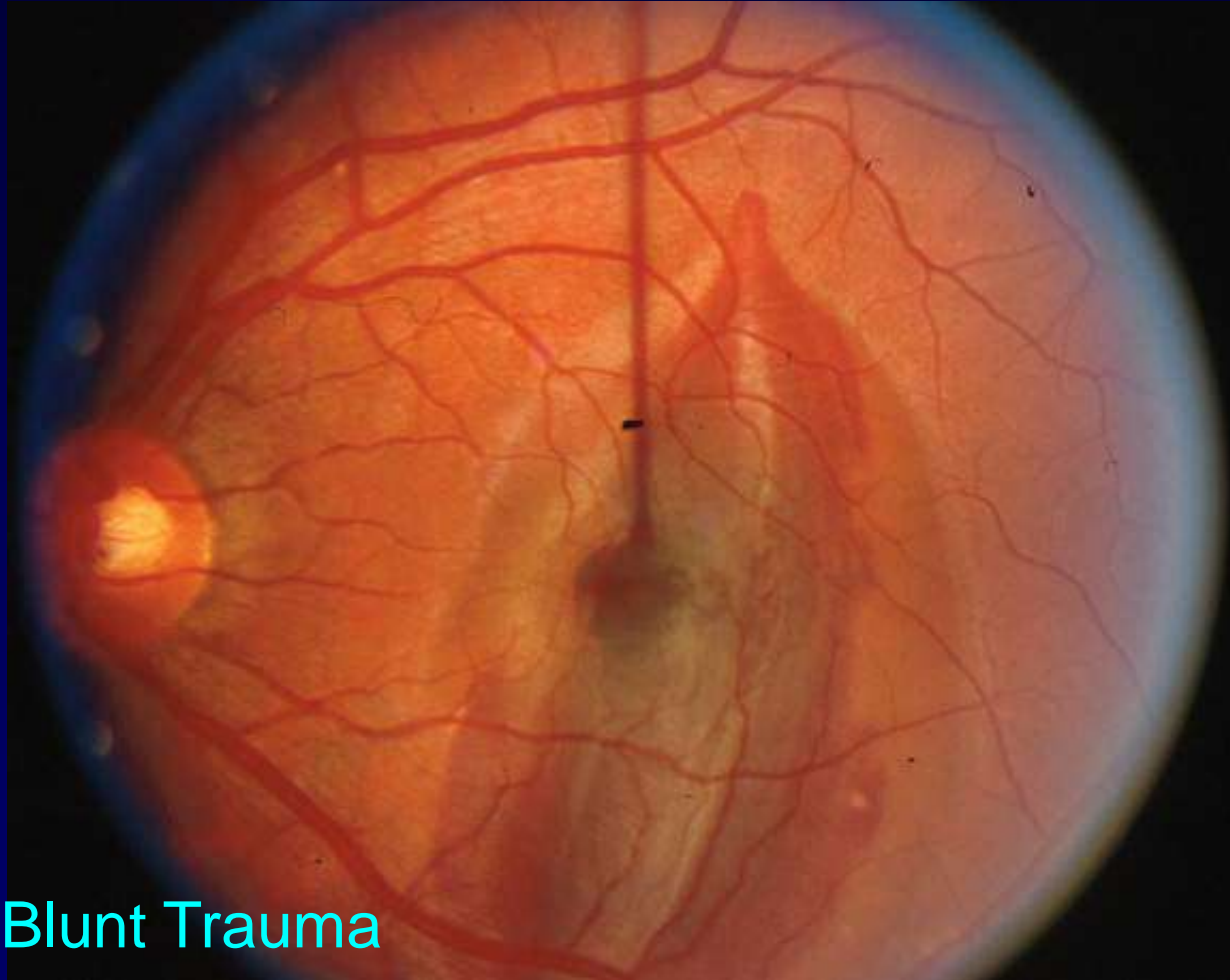
Retinal Detachment



Retinal Detachment Repair



Choroidal Rupture & Retinal Hemorrhage



s/p Blunt Trauma

Endophthalmitis

- Infection throughout the inside of the eye cavity
- Pain, Decreased Vision, Red eye, Hypopyon, Vitreous inflammation
- Etiology:
 - Following trauma or surgery
 - Endogenous (in setting of systemic illness -- e.g. sepsis, pneumonia, endocarditis)
- Requires **urgent treatment** with injection of Antibiotics & sometimes surgery

Endophthalmitis



Hypopyon

Severe Intraocular Infection

Ruptured or Lacerated Globe

Ruptured or Lacerated Globe

- Be suspicious with blunt trauma, projectile injury, contact with sharp object, or trauma from hammering metal on metal
- CT scan of orbits (thin cuts – axial and coronal) to rule out intraocular foreign body – No MRI (in case of metallic FB)
- **NEVER** try to remove a penetrating Foreign Body

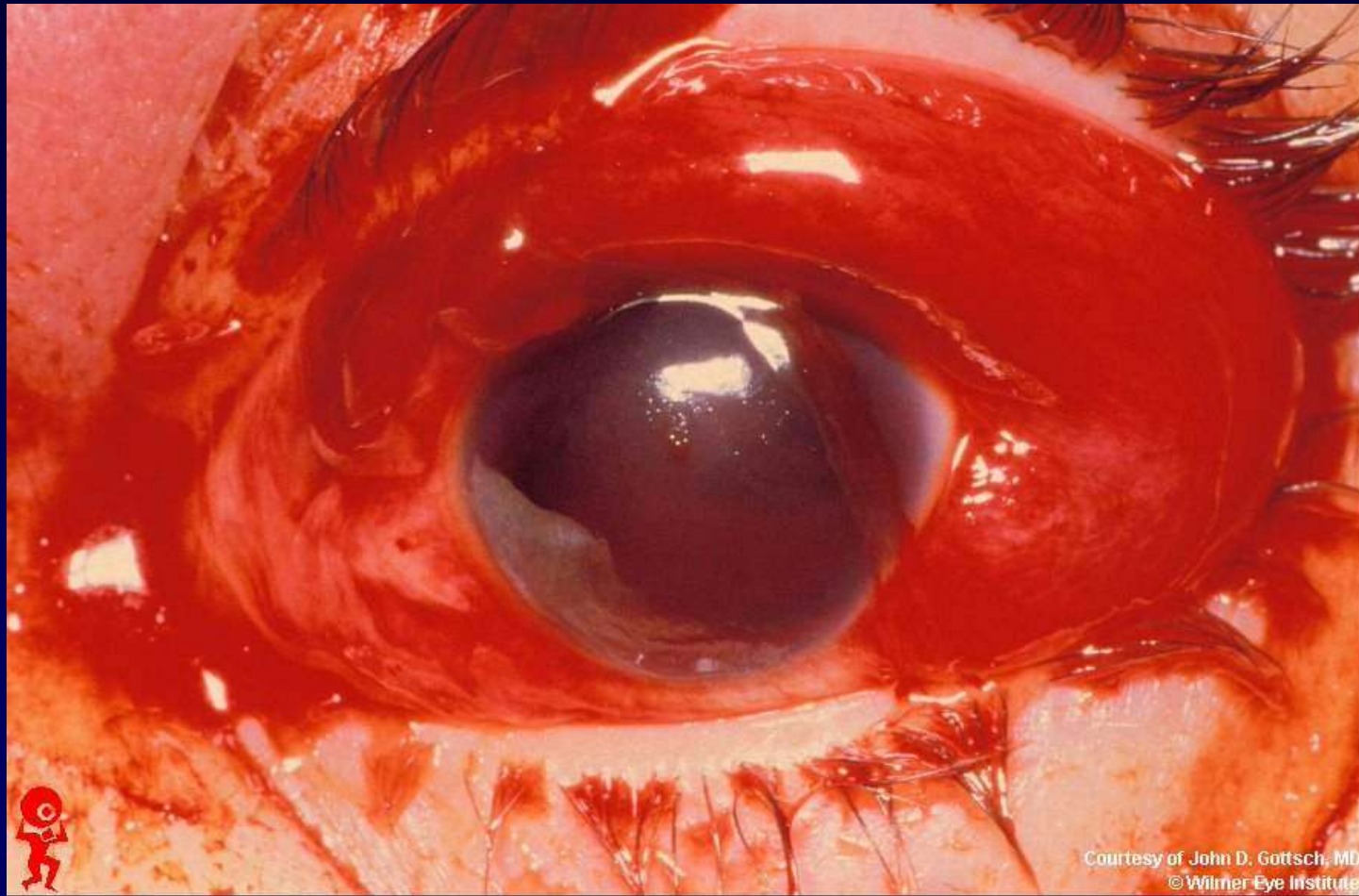
Ruptured or Lacerated Globe

- “Bloody chemosis” – hemorrhagic swelling of conjunctiva
- Uveal prolapse – **brown spot** on the sclera or cornea
- Irregularly shaped pupil
- Hyphema
- Lowered intraocular pressure
- If rupture or laceration is suspected, **stop** the examination immediately and place a hard shield (NOT A PATCH) over the eye.

Bloody Chemosis



Bloody Chemosis/Hyphema



Courtesy of John D. Gottsch, MD
© Wilmer Eye Institute

Corneal Laceration

Irregular
pupil --

Due to iris
prolapse
through
laceration



Courtesy of Mark Metzler and C. P. Wilkinson, MD
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Corneal Laceration

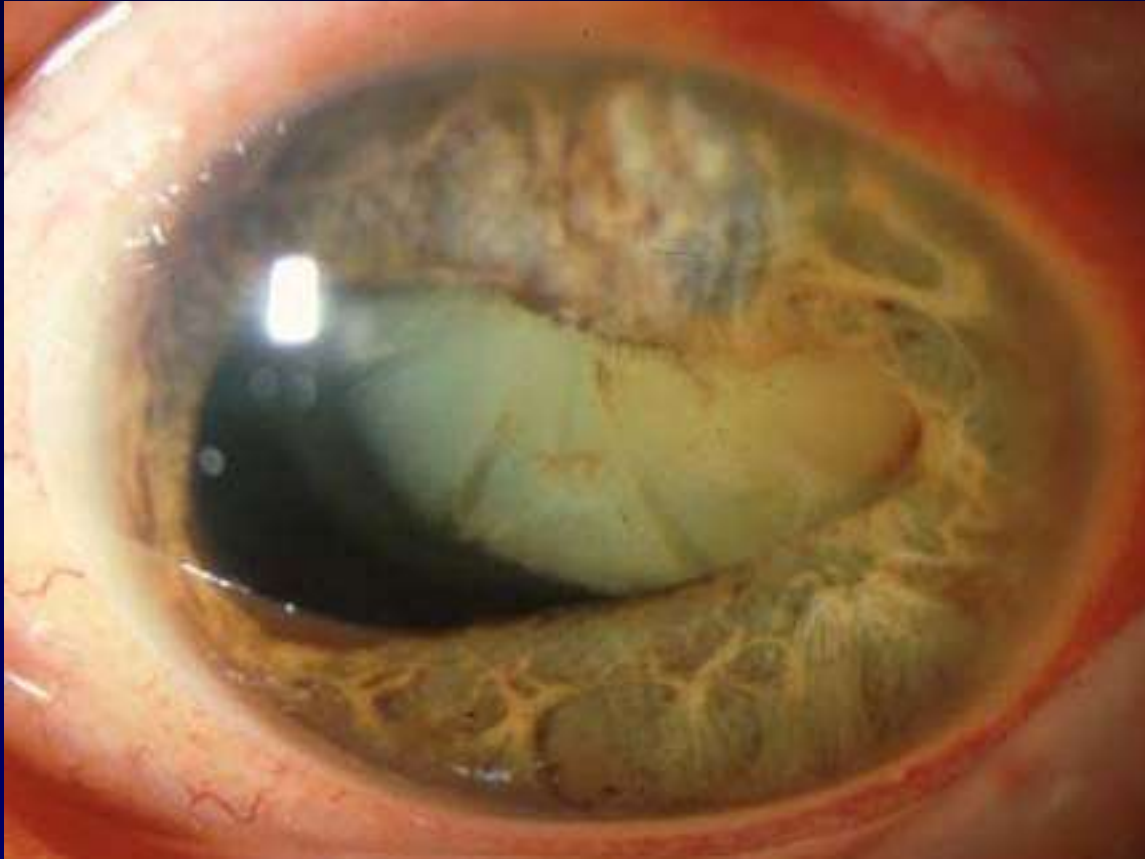


Courtesy of Nicholas T. Iloff, MD
© Wilmer Eye Institute

Corneal Laceration

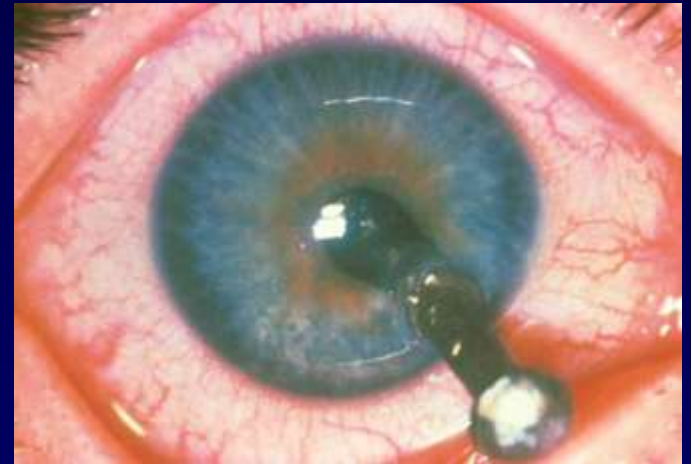


Traumatic Cataract

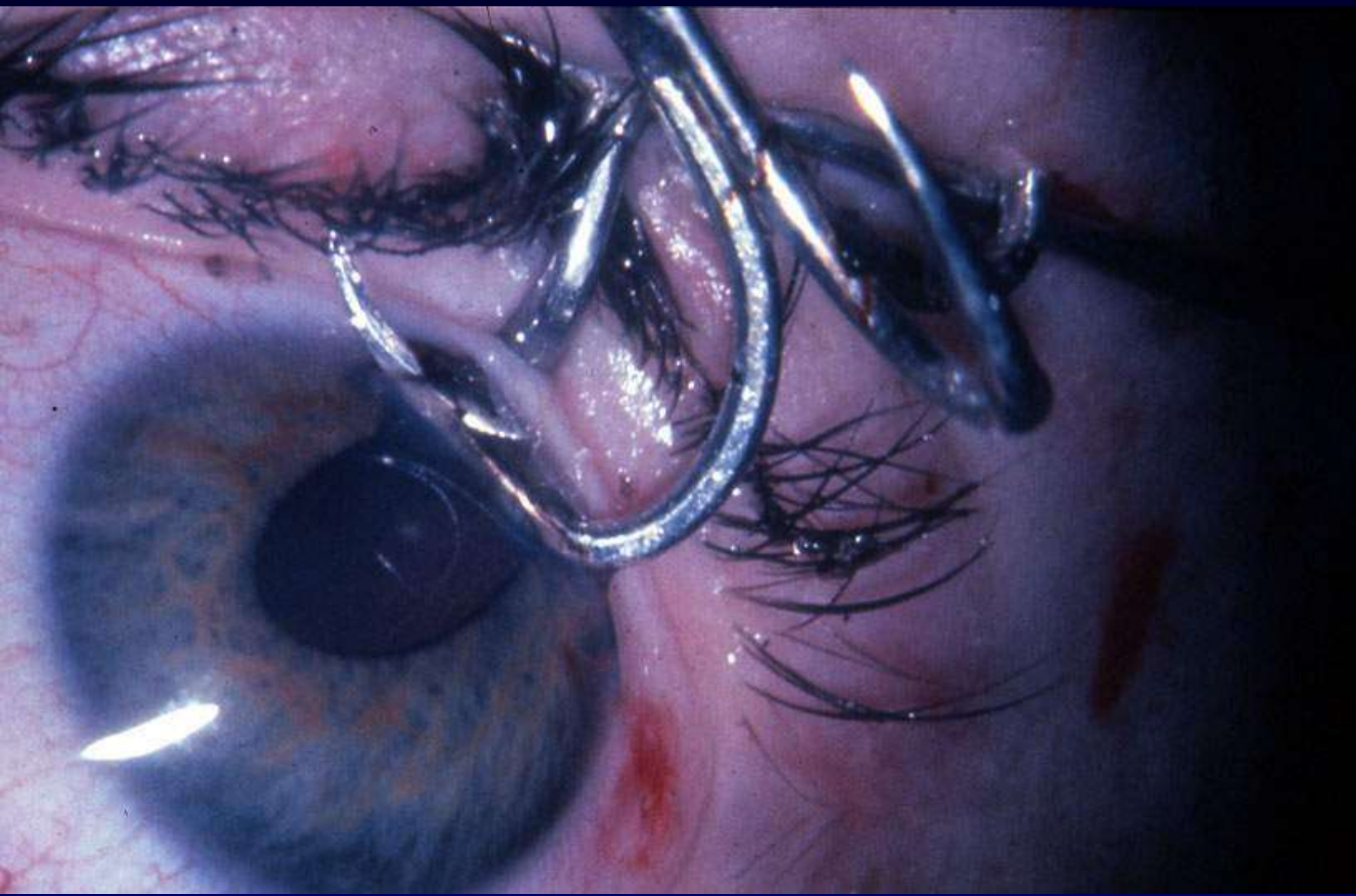


Penetrating Ocular Trauma









Ruptured or Lacerated Globe

If rupture or laceration is suspected, stop the examination immediately and cover eye with hard (plastic or metal) shield – **not a patch**

Protection during Transfer

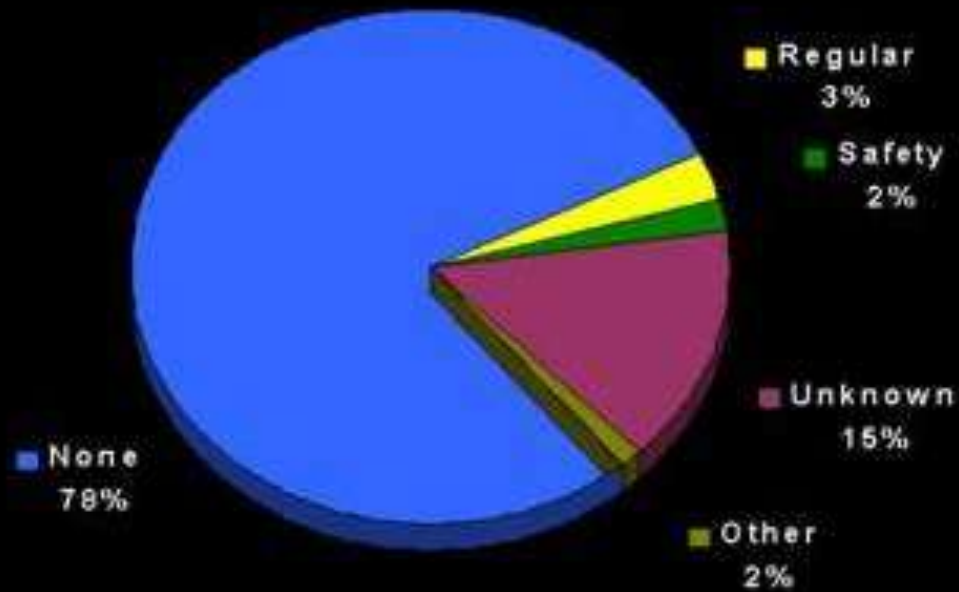


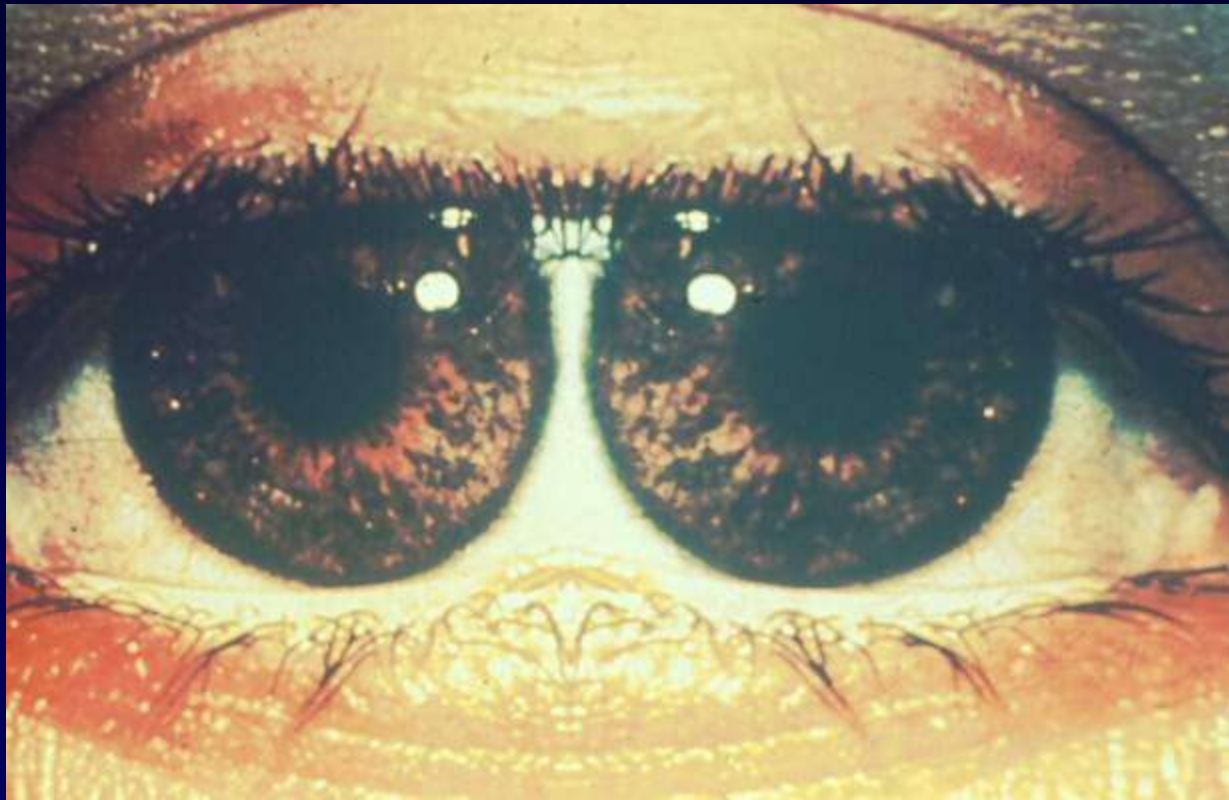
Eye Injuries

PREVENTION

Prevention

Eye Protection









THANK YOU!



Ocular Trauma and Emergencies

Jacob J. Yunker, M.D.

University of Kentucky College of Medicine

Partial Surgery List

- **Retina:**
 - Scleral Buckle; Membrane Removal; Vitrectomy; Endo Laser
- **Lens:**
 - Cataract extraction +/- IOL; Secondary IOL; IOL Exchange
- **Strabismus:**
 - Muscle procedure
- **Cornea:**
 - Penetrating Keratoplasty; Pterygium with conjunctival transplant; Lamellar/patch graft; Conjunctival autograft
- **Oculoplastics:**
 - Dacryocystorhinostomy; Ptosis repair; Ectropion and Entropion repair; Lid laceration; Endoscopic brow lift; Levator procedures; Orbital decompression; Enucleation; Full thickness lid tumor

Partial Surgery List

- **Glaucoma:**
 - Trabeculectomy; Seton procedures
- **Cornea:**
 - Radial keratotomy (RK); Pterygium; LASIK; Excimer laser surgeries (PRK, PTK); Automated Lamellar Keratoplasty (ALK); Astigmatic Keratotomy (AK)
- **Oculoplastics:**
 - Blepharoplasty; Tarsorrhaphy; Chalazion; Temporal artery biopsy; Excision of mass - partial thickness lid tumor; Conjunctivoplasty; Canthal plication; Trichiasis; Nasolacrimal duct (NLD) probing; Conjunctival tumors