Trauma Rounds

Alison Bozung, OD, FAAO

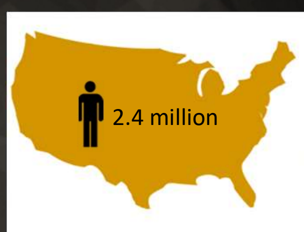
Disclosure Statement:
None

Who said it?

"An ounce of prevention is worth a pound of cure.."

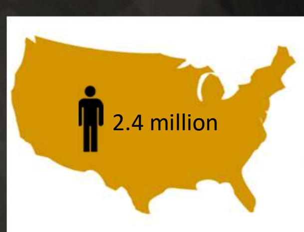
Introduction

- Each year an estimated 2.4 million eye injuries occur in the United States[1]
- Men >> women



Introduction

- Each year an estimated 2.4 million eye injuries occur in the United States
- Men >> women
- 20-50 years of age
- Occupational Safety and Health Administration (OSHA) estimates workplace eye injuries cost $300 million a year in lost productivity, medical treatment, and worker compensation.



Mechanisms of Ocular Trauma

1. **Blunt Trauma**

Rapid IOP increase and equatorial expansion.

2. **Sharp Object**

Full or partial thickness laceration. Penetrating or perforating.

3. **Projectile**

High speed, small sized particles may penetrate eye wall.

1) https://www.aao.org/topic-detail/trauma--europe 2) https://www.eyeworld.org/article-taking-a-team-approach-to-ocular-trauma
3) https://webeye.ophth.uiowa.edu/eyeforum/atlas/pages/metallic-FB-cornea/index.htm

History

- What happened…
  - High-velocity trauma?
  - Sharp object?
  - Blunt trauma?
  - Assault?
  - Any other injuries?
- Get the WHOLE story..

Basic examination

1. History
2. Visual acuity
3. Pupils
4. Slit lamp
5. Extraocular motilities
6. Intraocular pressure
7. Fundus

When there is concern for open globe, do we..

1. Check EOMs
2. Check IOP
3. Dilate?

Not if the globe is obviously open or disorganized.

Adnexa
- Eyelid lacerations
- Orbital fracture

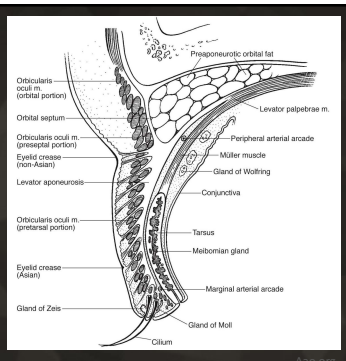
Cornea + Conjunctiva
- Corneal abrasion
- Conjunctival laceration
- Corneal foreign body
- Chemical burn

Anterior Chamber
- Iritis
- Hyphema

Retina
- Vitreous Hemorrhage
- Retinal tear or detachment
- Commotio retinae
- Purchter's Retinopathy
- Choroidal rupture

Open Globe

Eyelid lacerations



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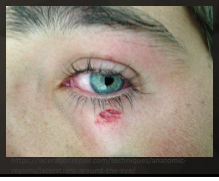
Small, superficial abrasions

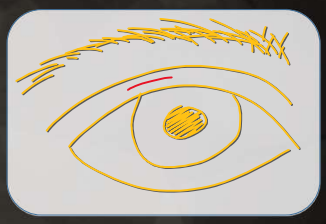
- Rinse and clean wound
- Inspect gently for depth of damage
- Topical antibiotic ointment
- +/- Steri-Strip or Leuko-strip placement
- +/- Tissue adhesive
- *Assess if tetanus booster is up to date*



When do we treat?

- Superficial, simple lacerations that are:
  1. Horizontal
  2. Follow the skin lines
  3. Involve less than 25% of lid length

…will usually heal well without suturing



When to refer

- Deep or long lacerations
- Lid margin involvement
- Full thickness
- Canalicular involvement

https://ukemigquickhit.wordpress.com/2014/03/26/ocular-trauma/
https://lacerationrepair.com/techniques/anatomic-regions/lacerations-around-the-eye/

Orbital Fractures

Evaluating orbital fractures

1. Visual acuity, pupils
2. Palpate
   - Crepitus, orbital rim, hypoesthesia
3. Exophthalmometry
   - Proptosis vs enophthalmos
4. Motilities
   - Individual gazes with cover test
5. Dilated exam
6. ROS:
   - Nausea, bradycardia, light-headedness?

Meddean.luc.edu

Hello.org

Oculocardiac Reflex

- Triad of signs:
  1. Bradycardia (<60 bpm)
  2. Nausea
  3. Syncope
- Indication of trapped muscle or soft tissue
- More common in children or young adults
  - More bone elasticity
  - "Greenstick fracture"

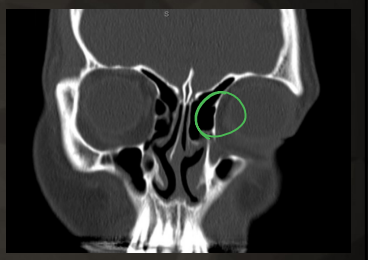
When do we order imaging??

When do I order imaging?

- Enophthalmos or exophthalmos
- Diplopia in primary gaze
- Notable EOM restriction in any gaze
- Small to moderate diplopia lasting > 1-2 weeks

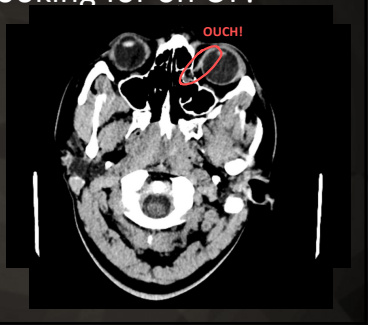
What are we looking for on CT?

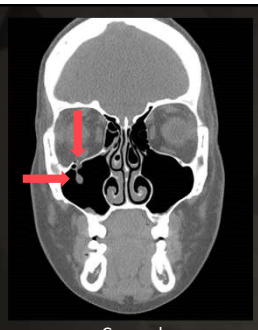
- Deflected EOM course



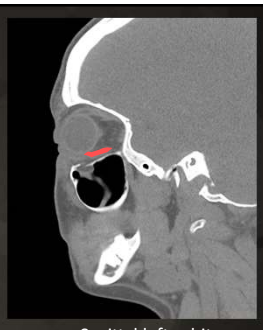
What are we looking for on CT?

- Deflected EOM course
- Orbital emphysema
- Sinus debris/blood
- Displaced vs non displaced fracture
- Globe displacement
- Orbital content herniation



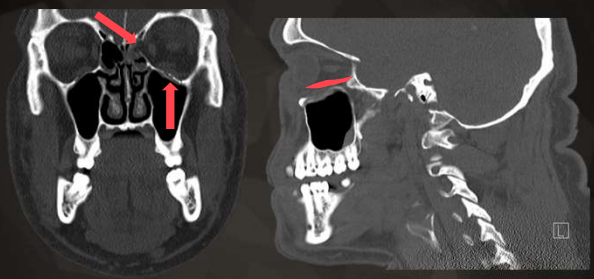


Coronal



Sagittal left orbit

Likely blood in maxillary sinus, displaced floor fracture



Coronal Sagittal left orbit

Displaced medial fracture and non-displaced floor fracture

Management of Orbital Fractures

- Ice packs and nasal decongestants x 1 week
  - Warn not to blow nose, Valsalva, etc
  - Tylenol for pain
- When do I prescribe oral antibiotics?
- Should I refer this patient?

When do I prescribe oral antibiotics?

- Consider deferring use for low risk patients[1]
  - Those without URI
  - Those not using steroids or otherwise immunosuppressed
- 0.8% infection rate in orbital fractures in 2005 Australian study[2]
- When you *do* prescribe, consider 5-7 day course
  - *(i.e. cephalexin or penicillin derivative)*

1. Reiss B, Rajoub L, Mansour T, Chen T, Mumtaz A. Antibiotic Prophylaxis in Orbital Fractures. Open Ophthalmol J. 2017; 11: 11–16. 2. Ben simon GJ, Bush S, Selva D, Mcnab AA. Orbital cellulitis: a rare complication after orbital blowout fracture. Ophthalmology. 2005;112(11):2030-4. 3. Gaal A, Bailey B, Patel Y, et al. Limiting antibiotics when managing mandible fractures may not increase infection risk. J Oral Maxillofac Surg 2016;74:2008–2018.

Referring orbital fractures

Urgently

- Evidence of muscle entrapment
  - (+) CT muscle entrapment visualized
  - (+) Forced duction
  - (+) Oculocardiac reflex

1-2 weeks

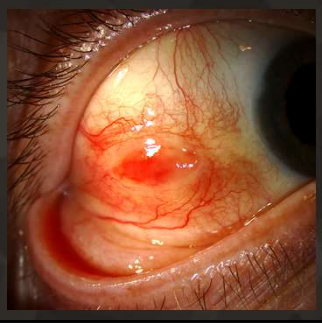
- Symptomatic: Persistent diplopia after edema resolves
- Asymptomatic: large or complex (multi-bone) fractures

Monitor

- 1 week, 1 month
- Exam + EOMs

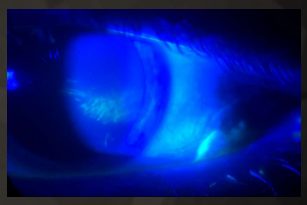
Conjunctival Lacerations

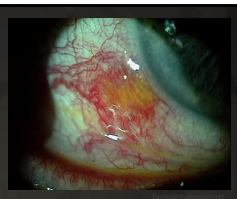
~60 yo female, dog paw to eye



Conjunctival laceration

- Partial or full thickness
  - Full thickness can affect underlying Tenon's capsule or sclera
- Common etiologies
  - Fingernail
  - Make up wand / brush
  - Pet claw
  - Tree branch
- Personal favorite
  - Trying on over-the-counter reading glasses



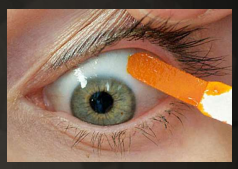


Conjunctival lacerations

Conjunctival laceration

Check for extent of laceration

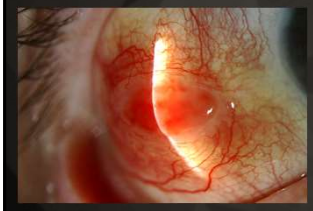
- Partial thickness vs full thickness?
- Any underlying scleral laceration?
- Seidel test – "paint" fluorescein strip over area of concern

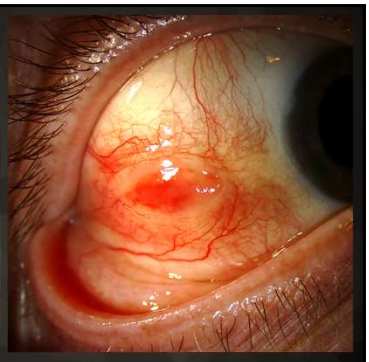


Management

- Broad spectrum antibiotic drop or ointment
- Rarely require surgical repair

Full thickness conjunctival laceration

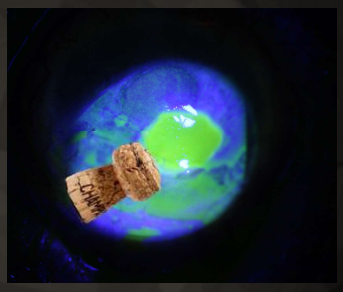




Corneal Abrasions

Corneal abrasion

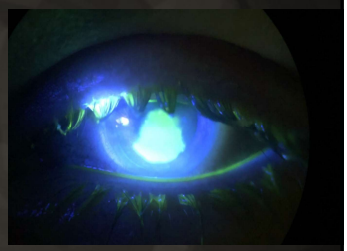
- Common etiologies
  - Same as conjunctival abrasions
- Personal favorite?
  - Champagne cork



Clinical Evaluation

Symptoms
- Conjunctival inflammation, epiphora, photophobia
- +/- blurred vision

Signs
- Epithelial defect, no infiltrate*
- +/- corneal edema
- +/- mild AC reaction



Management of Corneal Abrasions

1. When do we debride the epithelium?
2. When do we use bandage contact lenses?
3. When do we cycloplege?
4. How closely do we follow up?

Management of Corneal Abrasions

1. When do we debride the epithelium?

Loose tags of devitalized epithelium will not "tack" back down.

Debride when loose tissue will *impede* healing.

Can be done with cotton swab or Weck Cell.

Management of Corneal Abrasions

2. When do we use bandage contact lenses?

Depends on patient and pain level, but they can be of huge benefit!

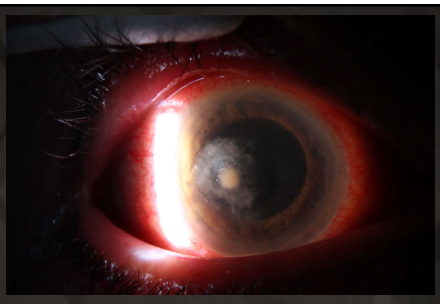
Think again:	Questionable reliability of patient follow up.
	Contact with vegetative matter.
	Any question of infectious component.

Management of Corneal Abrasions

3. When do we cycloplege?

Consider when:	Large abrasion
	Secondary corneal edema
	Secondary AC reaction

Secondary AC reaction.. Should we use steroids?



A cautionary tale…

Management of Corneal Abrasions

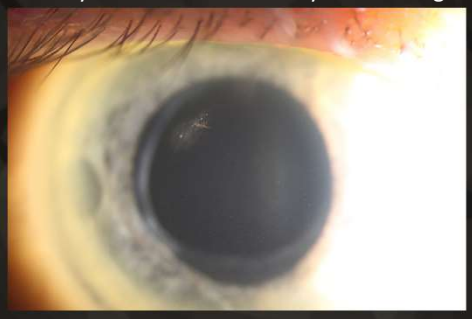
4. How closely do we follow up?
   More involved treatment = more often!

   BCL placement: See every ~2-3 days
   Replace BCL unless damage > benefit

   No BCL: Every ~3-5 days

Corneal Foreign Body

79 yo male History of bee sting



Courtesy of Nimesh Patel, MD & Sonia Yoo, MD

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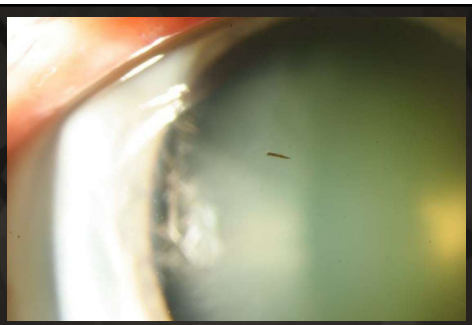


2009!

Corneal foreign body

- Second most common form of ocular trauma
- Most common materials: metal, glass, organic material

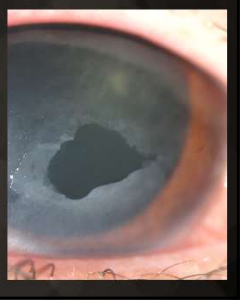
- Personal favorite: insect wing
- Least favorite: worker's comp

1. Record mechanism
2. Assess depth of FB, check AC
3. Infiltrate?
4. DFE
5. Educate and consent patient

6. Lift foreign body
   - 25-gauge 5/8” needle tip*
   - Magnetic spud
7. Burr / Algerbrush
8. Antibiotic +/- cycloplegic
9. Follow closely

Chemical Burns

46 yo male, CL solution error VA 20/100

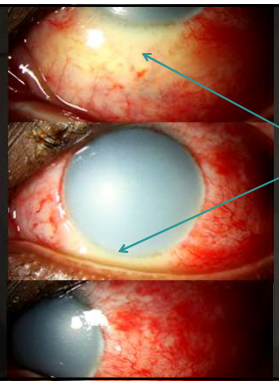


~20s yo male, cleaning supply injury at work

Chemical burn

- 36,000 chemical burns annually in US*
- Men > Women
- Most at risk?
  - 20 to 29 year-olds
  - Work environments
- Alkaline (54%) > Acid (46%)*
  - *Alkaline (pH > 10): cement, cleaners, bleach, ammonia, fertilizer*
  - *Acid (pH < 4): sulfuric, hydrochloric, hydrofluoric, battery acid*

Haring RS, Sheffield ID, Channa R, Canner JK, Schneider EB. Epidemiologic Trends of Chemical Ocular Burns in the United States. JAMA Ophthalmol. 2016;134(10):1119-1124.



Clinical findings

- Conjunctival injection
- Conjunctival ischemia
- Chemosis
- Corneal haze
- Corneal epithelial defect
- Elevated IOP

Roper-Hall Classification Method for Ocular Chemical Burns

Grade	Prognosis	Cornea	Conjunctiva/Limbus
I	Good	Corneal epithelial damage	No limbal ischemia
II	Good	Corneal haze, iris details visible	<1/3 limbal ischemia
III	Guarded	Total epithelial loss, stromal haze, iris details obscured	1/3 to 1/2 limbal ischemia
IV	Poor	Cornea opaque, iris and pupil obscured	>1/2 limbal ischemia

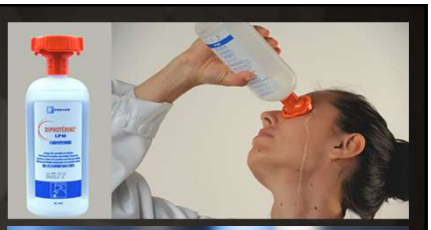
Dua Classification Method for Ocular Chemical Burns

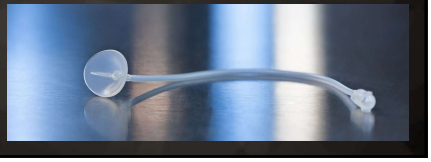
Grade	Prognosis	Limbal Involvement	Conjunctival involvement
I	Very good	0 clock hours	0%
II	Good	⩽3 clock hours	⩽30%
III	Good	>3–6 clock hours	>30–50%
IV	Good to guarded	>6–9 clock hours	>50–75%
V	Guarded to poor	>9–<12 clock hours	>75–<100%
VI	Very poor	Entire limbus	Total conjunctiva (100%) involved

Chemical burns: ACUTE ACTION!

Good	Better	Best
Clean tap water	Balanced saline solution (BSS)	Cederroth, Diphoterine, etc.
Holding eyelids open	Eyelid retractors	Morgan lens

- Irrigation + pH check every 15-30 minutes
- Sweep fornices for residual FB material (i.e. cement)





Acute (0-1 week)

- Monitor IOP, inflammation, epithelial defect

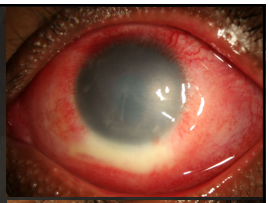
Early repair (1-3 weeks)

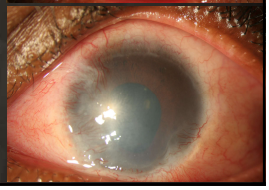
- Grade I-II: re-epithelialization begins
- Grade III-IV: minimal epithelialization
  - Nidus for second inflammation wave

Late phase (>3 weeks)

- Collagenase and collagen synthesis peaking
- Grade I: fully epithelialized
- Grade II: epithelialized + focal pannus
- Grade III: significant pannus +/- symblepharon

Adapted from eyesteve.com





Diagnosis & Management

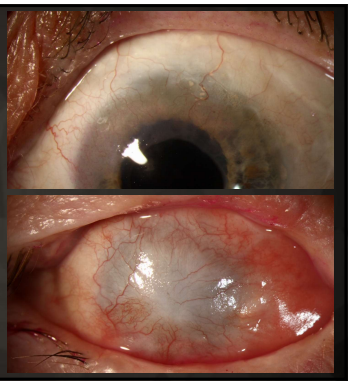
- Grade I:
  - Prednisolone acetate 1% QID
  - Polytrim or erythromycin QID
  - Atropine BID
  - Frequent non-preserved ATs
  - Follow every 2-3 days
- Grade II-IV
  - Prednisolone acetate 1% Q1-2h
    - Progestational steroid (i.e. medroxyprogesterone 1%) may be used after 7-10 days
  - Polytrim QID
  - Atropine BID
  - Oral:
    - Doxycycline 100mg BID
    - Vitamin C 2g BID
  - Follow every 1-2 days

Diagnosis & Management

- Consider Prokera®
  - Within first 2 weeks thought to be most helpful

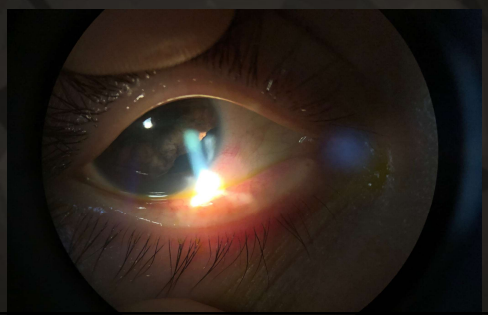
Chronic Issues

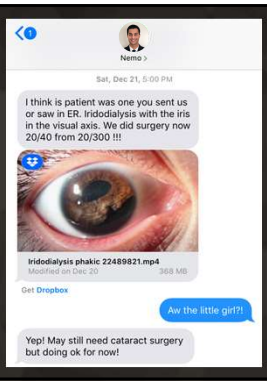
- Corneal opacity
- Limbal stem cell deficiency
- Neurotrophic keratopathy



Iris trauma:
Iritis, hyphema, iridodialysis

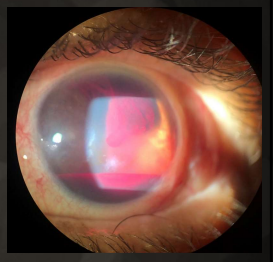
18 yo female, MVA/airbag injury VA 20/300





Traumatic iritis or hyphema

- Accumulation of white or red blood cells in anterior chamber
- Typically result of blunt trauma
- May be associated with obvious iris trauma
  - Iris tear
  - Iris dialysis



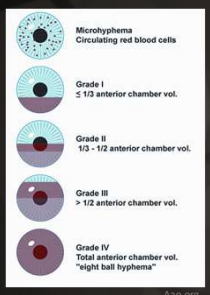
70 yo male, hit himself in the eye
VA HM

Management

Topical corticosteroids Q2-4h
- Slow taper

Topical cycloplegic daily BID
- Stop when AC nearly quiet

Hyphema?
- Acetaminophen PRN
  - Avoid ibuprofen or aspirin!
- Take it easy
  - Restrictions to ambulation only
  - Head of bed elevated 30*



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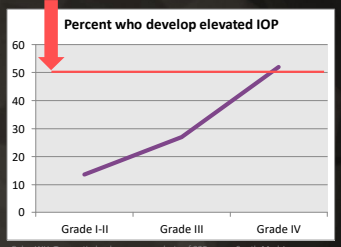
50% chance of elevated IOP with rebleeds – usually occur within 3-7 days



Coles WH. Traumatic hyphema: an analysis of 235 cases. South Med J. 1968;61(8):813-6.

Other considerations

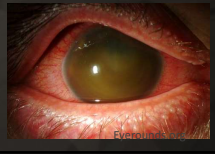
Elevated IOP?
- Topical: Aqueous suppressants
- Oral: Acetazolamide, methazolamide

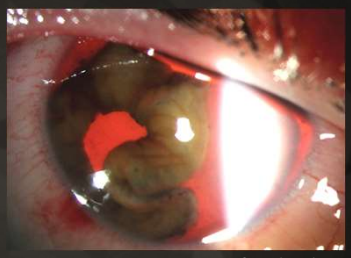
When to lower IOP?	
Sickle Cell (+)	>24mmHg
Sickle Cell (-)	>30mmHg

Sickle Cell trait / disease?
- Test patients of African or Middle-Eastern descent
- AVOID acetazolamide
- Methazolamide *may* be used with caution

Who needs surgery?

- Any corneal blood staining
- Uncontrolled IOP
  - > 60mmHg x 2 days
  - > 35mmHg x 1 week
  - > 25mmHg x 1 day in Sickle cell (+)
- Total hyphema > 5 days





Courtesy of Nimesh Patel, MD

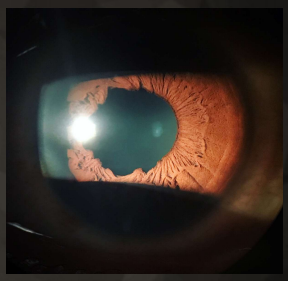
Other Considerations

Iris trauma?

- Avoid gonioscopy for at least 1 month, but DO IT

What do the numbers show?

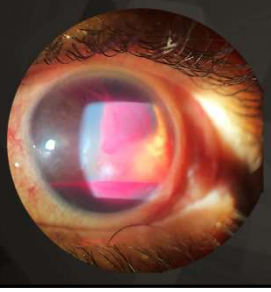
- Angle recession present in up to 85% of patients with hyphema[1]
- Higher risk of glaucoma[2]:
  - Angle recession ≥ 180°
  - More pigment in TM
  - Higher initial IOP

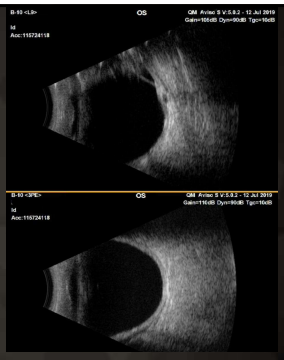


1. Blanton FM. Anterior chamber angle recession and secondary glaucoma. A study of the aftereffects of traumatic hyphemas. Arch Ophthalmol. 1964;72:39-43.
2. Sihota R, Sood NN, Agarwal HC. Traumatic glaucoma. Acta Ophthalmol Scand. 1995;73(3):232-4.

Back to our patient...

Does the trauma make SENSE?





Posterior Segment Trauma

Flashes & Floaters & Vitreous Hemorrhage

Flashes + Floaters: differentials

Most likely
- PVD
- Retinal tear
- Retinal detachment
- Vitreous hemorrhage

Less likely
- Migraine aura
- Retinal ischemia

←10-15% of all acute, symptomatic PVDs have a retinal tear/break

Eyerounds.org

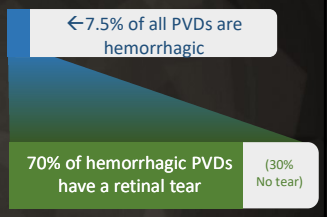
Vitreous hemorrhage

- Ask about symptoms!
- What does the *other eye* look like?
  - Any signs of retinopathy, vein occlusion, neovascularization, etc
- Where does blood come from?
  1. Vitreoretinal
  2. Retinovascular
  3. Trauma
  4. Choroidal (less likely)

Researchgate.org

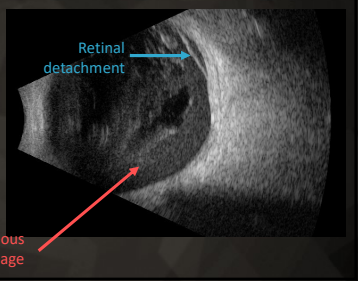
Small vit heme: good visualization

- NVD/ NVE?
- Hemorrhagic PVD?
  - May occur at disc
  - More common in in patients on blood thinner

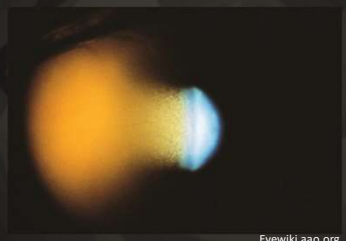


Big vit heme: poor visualization

- Needs ultrasound to rule out retinal break or detachment



How about old vitreous hemorrhage?



Eyewiki.aao.org

Traumatic Retinal Detachments

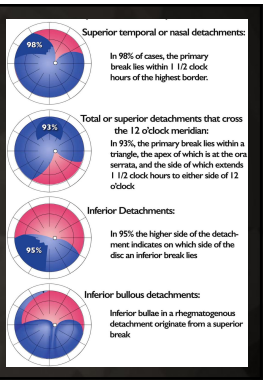
Typically Rhegmatogenous

- Associated with retinal tears or dialysis
- Typically has a corrugated surface

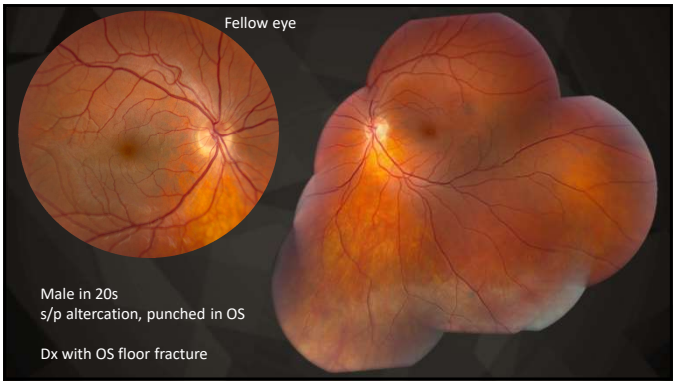
⇨ Vitrectomy + gas/oil
Scleral buckle + laser

Where are the retinal break(s)?

- Remember Lincoff's Rule
- Most important in macula-on RRDs, so you can have patient position better

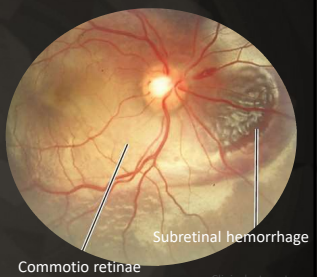


Commotio Retinae



Commotio retinae

- Caused by blunt trauma
- Visible retinal whitening
- May be associated with retinal or subretinal hemorrhages
- Immediately following trauma, patient may notice blurred vision or a "dim spot"



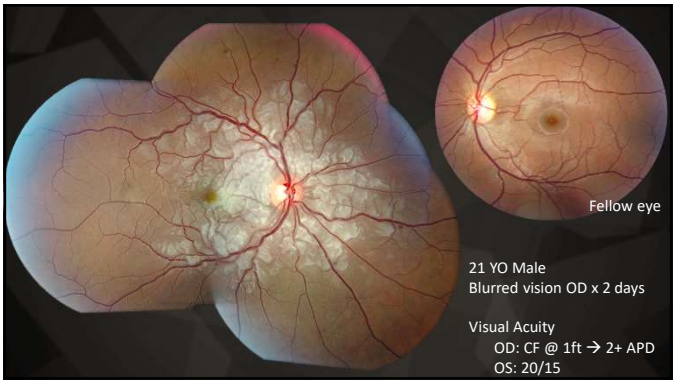
Commotio retinae

Management

- Assess for any comorbid features of ocular trauma
- No acute treatment
- Monitor in 1-2 weeks

Typically resolves on its own and remains largely asymptomatic unless complications arise involving the macula

Purtscher's Retinopathy

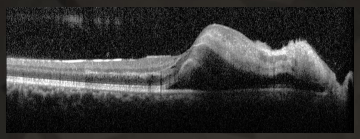


Purtscher's Retinopathy

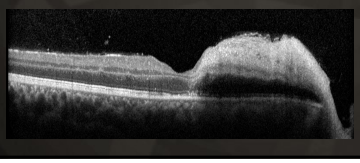
- Cotton wool spots, hemorrhage, and "Purtscher flecken" in the posterior pole, predominantly around the optic disc.
- Vision loss may be immediate or delayed
- Etiology
  - Head trauma
  - Compressive chest injury
  - "Purtcher-like retinopathy" → Long bone fracture, vasculitis, pancreatitis

Posterior Pole OCT

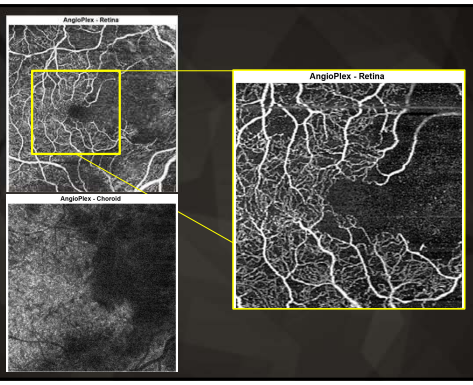
Follow Up: 1 week



Initial Visit
CF

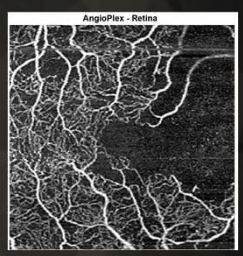


1 week
20/300



Putcher's Retinopathy: in summary

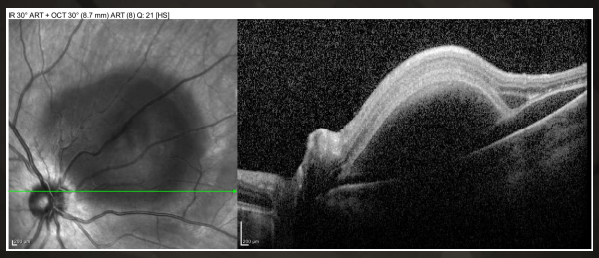
- Vision loss 0-48 hours after injury
- Treatment options limited
  - High dose IV steroids have been used
  - *Benefit is not statistically significant*[1]
- Prognosis
  - Guarded
  - Based on initial VA



[1] Miguel AI, Henriques F, Azevedo LF, Loureiro AJ, Maberley DA. Systematic review of Purtscher's and Purtscher-like retinopathies. Eye (Lond). 2013;27(1):1-13.

Choroidal Rupture

~20yo female hit with lamp post VA 20/20

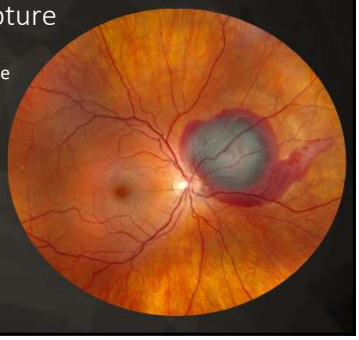


Choroidal Rupture

- Break in the choroid, Bruch's membrane, and the retinal pigmented epithelium
- Etiologies
  - Trauma
  - Choroidal neovascularization (CNV)
  - Angioid streaks
  - Tumor

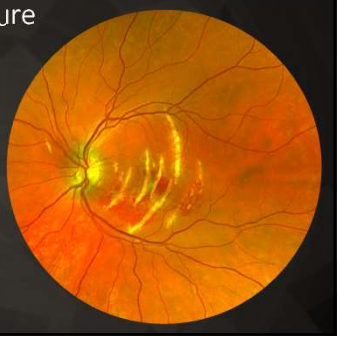
Signs of choroidal rupture

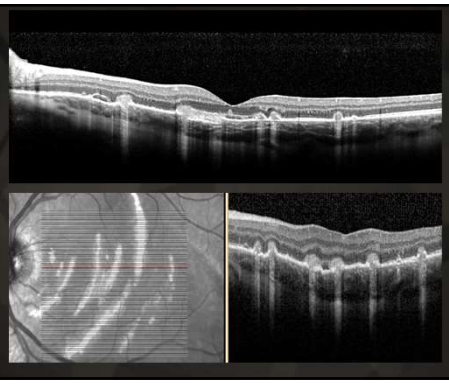
- Multi-layered deep red or purple hemorrhage
  - Sub-RPE hemorrhage
  - Sub-retinal hemorrhage



Signs of choroidal rupture

- Multi-layered deep red or purple hemorrhage
  - Sub-RPE hemorrhage
  - Sub-retinal hemorrhage
- Concentric yellow or white subretinal streaks
  - Often located near optic nerve



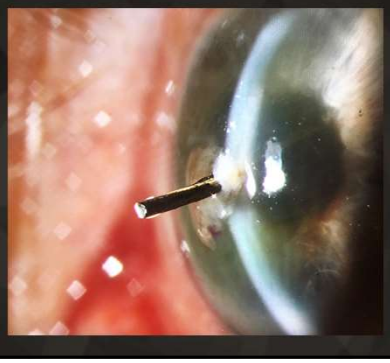


Complications

- Choroidal neovascular membranes (CNVM) more likely[1]:
  - Older age
  - Macular location
  - Longer length of rupture
- Treatment
  - Careful observation for SRF
  - Anti-VEGF injections → when vision threatening
- Outcome depends primarily on location of injury

Ament CS, Zacks DN, Lane AM, et al. Predictors of Visual Outcome and Choroidal Neovascular Membrane Formation After Traumatic Choroidal Rupture. *Arch Ophthalmol*. 2006;124(7):957–966. doi:https://doi.org/10.1001/archopht.124.7.957

Open Globe



Mechanism of injury

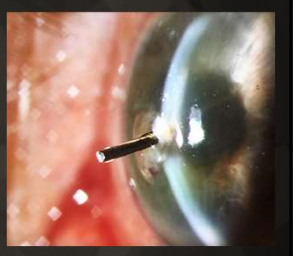
Open globes do not discriminate!

Blunt trauma leads to scleral rupture
- Equator: posterior to muscle insertions
- Limbus: corneoscleral junction

Projectile or sharp objects
- Penetrating injury
- Perforating injury
- Intraocular foreign body (projectile)

Evidence of open globe

- Penetrating eyelid injury
- Extensive subconjunctival hemorrhage
- Shallow or flat anterior chamber
- Vitreous hemorrhage or hyphema
- Hypotony
- Irregular pupil (especially peaked!)
- Intraocular foreign body (IOFB)



Avoid certain testing in obvious globes

1. EOMs → in obviously disorganized globes
2. IOP → when uveal contents exposed or corneal laceration
3. Dilate → when uveal contents exposed

Ocular Trauma Score (2002)

- Helpful in counseling patient
- Can aid in decision-making

Calculation of the OTS

Initial visual factor	Raw points
A. Initial visual acuity category	NLP=60 LP to HM=70 1/200 to 19/200=80 20/200 to 20/50=90 ≥20/40=100
B. Globe rupture	−23
C. Endophthalmitis	−17
D. Perforating Injury	−14
E. Retinal detachment	−11
F. Afferent pupillary defect	−10

Probability of visual outcome

Raw score sum	OTS–Score category	NLP (%)	LP/HM (%)	1/200-19/200 (%)	20/200-20/50 (%)	≥20/40 (%)
0–44	1	73	17	7	2	1
45–65	2	28	26	18	13	15
66–80	3	2	11	15	28	44
81–91	4	1	2	2	21	74
92–100	5	0	1	2	5	92

HM, hand movements; LP, light perception; NLP, no light perception; OTS, Ocular Trauma Score.

Open Globe: what should we do in office?

- Considered an emergency
- Protect the globe by placing a hard shield
- Instruct patient not to touch or rub eye
- Have patient stand or sit upright
- No food or fluids
- Up to date on tetanus?
  - Will be done at referral site, typically

Open Globe: what happens next?

Examination
- Open globe confirmed/suspected

Imaging
- CT orbit 1mm cuts w/wo contrast

Decrease risk of infection
- Assess tetanus status
- Systemic antibiotics (PO levofloxacin vs IV)
- Topical vancomycin or vigamox

Reduce collateral damage
- Start antiemetic
- Fox shield + bed rest (bathroom privileges)

Prepare for surgery
- Medical clearance for anesthesia
- NPO (6+ hours)

Surgery
- Goal is to close the globe and remove any IOFB

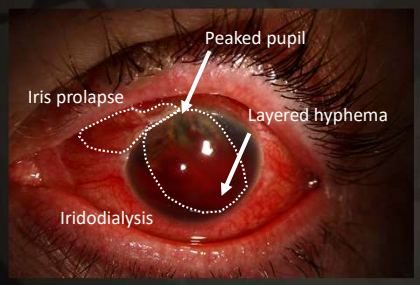
Open Globe: what happens next?

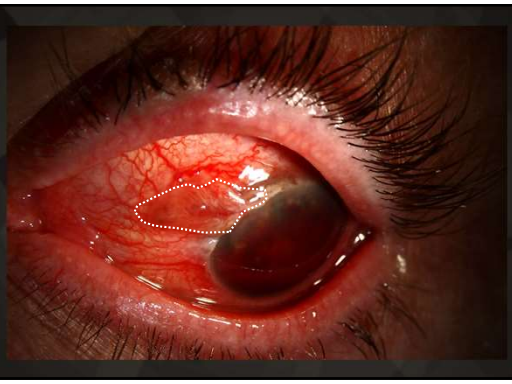
- Globe repairs often require multiple steps
- Outcome ultimately depends on..
  - Mechanism of injury
  - Severity of initial injury
  - Time to treatment/evaluation
  - Patient follow up and compliance

Now it's your turn.

Case 1

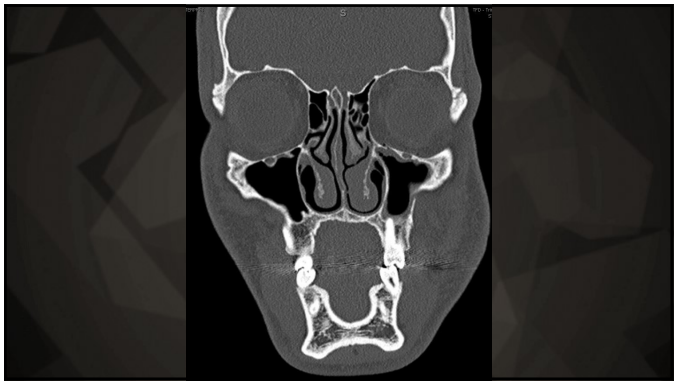
Middle aged male presents with blurred vision x 1 month since getting in a “slap fight”

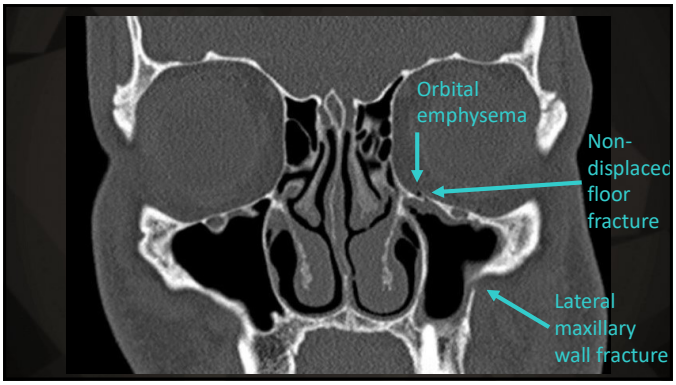




Case 2

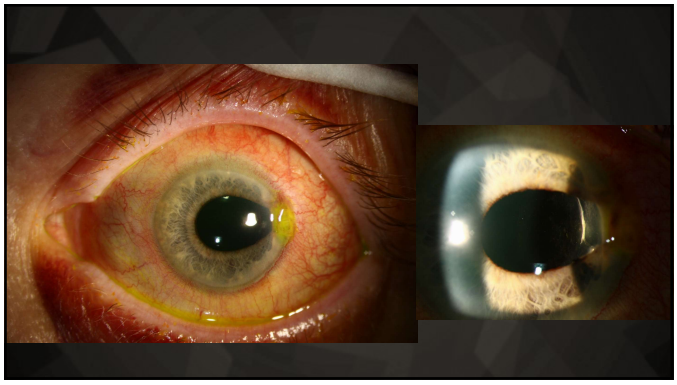
Young male presents with left eyelid and facial swelling + pain after motor vehicle accident.

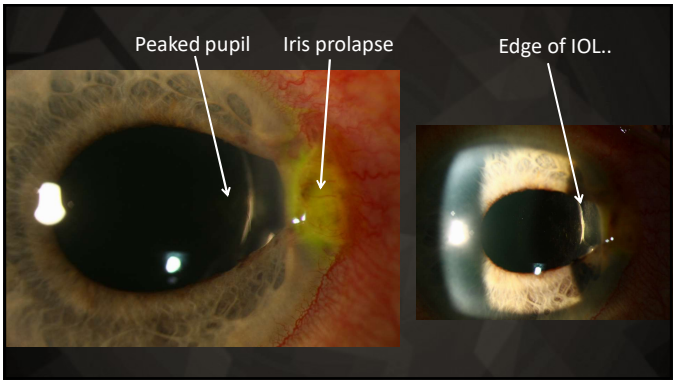




Case 3

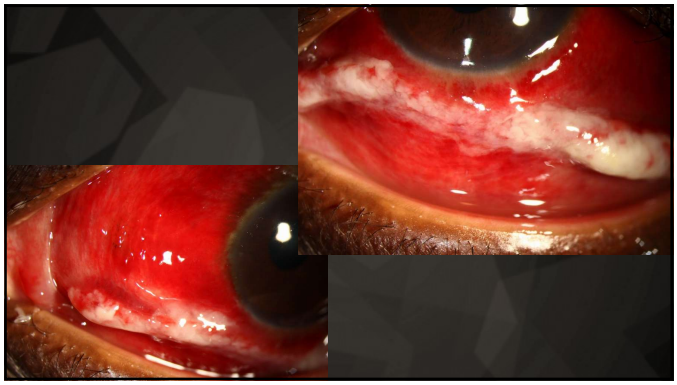
Middle aged female presents with irregular pupil after falling and hitting edge of table this morning.





Case 4

Young male presents with redness and irritation after being poked in the eye by a opponent's finger playing basketball.



Case 5

Young male with decreased vision in the left eye.

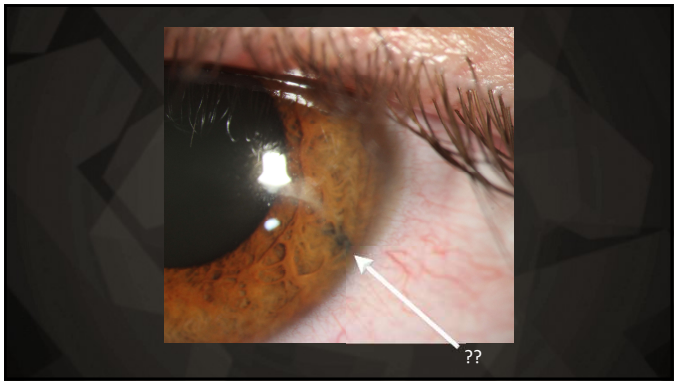
One month prior, he sustained a corneal abrasion at construction site that was treated with topical antibiotics.

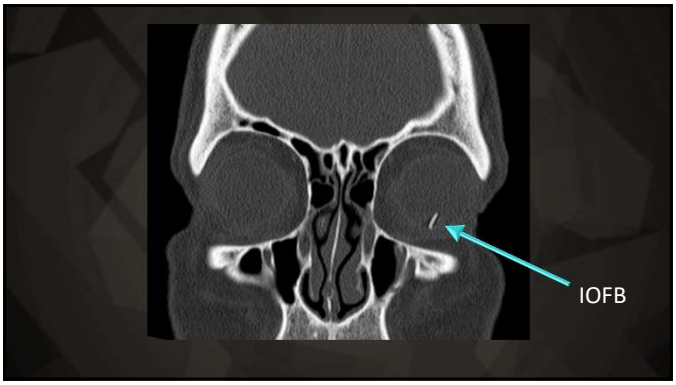
Case courtesy of Nimesh Patel MD & Diana Laura MD

Corneal scar

- 20/20 OD, 20/200 OS
- AC quiet / formed
- Vitreous haze
- Poor view posteriorly

- B scan suggestive of retinal detachment





Thank you.

alisonbozung@gmail.com

@all_things_eye