Trauma for the OD: A Case Management Approach
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Frequency of Traumatic Ocular Conditions
- Superficial injury of the eye and adnexa (41.6%)
- Foreign body on the external eye (25.4%)
- Contusion of the eye and adnexa (16.0%)
- Open ocular adnexa and eyeball wounds (10.1%)
- Orbital floor fracture (1.3%)
- Nerve injury (0.3%)

Eye Trauma Statistics
- 75% of the injuries were to males
- 48% occurred at home
- 29% caused by play or sports
- 77% of injury victims were not wearing eyewear
- 55% thought that injuries could have been avoided with patient education

Triage Considerations
- Urgency vs. Emergency
- Acute vs. Chronic
- Mild vs. Severe
- Progressive vs. Stable
- Document all calls

Virginia Eye Consultants
Tertiary Referral Eye Care Since 1963
- John D. Sheppard, MD, MMSc
- Stephen V. Scoper, MD
- Thomas J. Joly, MD, PhD
- Dayna M. Lago, MD
- Walter O. Whitley, OD, MBA, FAAO
- David M. Salib, MD
- Constance Okeke, MD, MSCE
- Mark Enochs, OD
- Esther Chang, MD

Rappon, J. Primary Care Ocular Trauma Management. Retrieved from
http://www.pacificu.edu/optometry/ce/courses/21042/primarycaretraumapg1.cfm

Eye Trauma Statistics
Source: American Academy of Ophthalmology, Eye Injury Snapshot 2009 Results
Who's Your Phone a Friend??

General Trauma Considerations
- Take care of the obvious
  - ABCDE's
  - Radiology
  - Concussion evaluation
  - Mental status of patient

Importance of History
- Take your time with the history
- Inquire about angle of impact
- Nature of insulting object
  - Sharp, dull, big, small
- Prior treatments
- What was your vision before the injury?

Evaluation of Ocular Trauma
- Visual acuity – MUST CHECK VA
- Pupil testing – reactivity, equality, symmetry, APD?
- Confrontation visual fields – evaluate gross defects
- EOMs – Most critical in the evaluation of blunt trauma
- Gross examination – Lids take the brunt of the trauma
- Slit lamp examination
- Tonometry*
- Dilation*
- B-scan ultrasonography
- Color vision
- Imaging studies – CT / MRI

Computerized Tomography
- If you suspect any of the following, a CT scan is indicated
  - History of loss of consciousness for more than 10 minutes
  - Alcohol intoxication
  - History of seizures
  - Unreliable history of the accident
  - Age less than 2 years
  - History of persistent vomiting
  - Bleeding from the nose, mouth or ear
  - Patient has serious facial injury
  - Penetrating injury to the skull
- No MRI for fear of metallic foreign body

Axial vs. Coronal CT Scans

Photo Courtesy of Tom Joly, MD, PhD and Derek Cunningham, DD
**Neuro-ophthalmologic Trauma**

- Third, fourth and sixth nerve palsies can all happen
  - Third nerve palsies associated with worst outcome
  - Sixth nerve palsies associated with best outcomes

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**Start with the Most Serious**

- Chemical burns
- Mechanical
  - Open globe
  - Closed globe
- Major orbital trauma
- Intraocular foreign body
- Head/Neck trauma

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**Chemical Burns**

- **Emergency!!!** - Every minute counts
- Do not waste time on Hx and PE
- Alkali burns more common and worse than acid
  - Alkali
    - Household cleaners, fertilizers, drain cleaners
  - Acid
    - Industrial cleaners, batteries, vegetable preservatives

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**Hughes Classifications of Ocular Burns**

- **Grade 1** (Very good prognosis)
  - No corneal opacity or limbal ischemia
- **Grade 2** (Good prognosis)
  - Corneal haze but iris details are clear. Less than 1/3 cornea limbus ischemia
- **Grade 3** (Guarded prognosis)
  - Sufficient corneal haze to obscure iris details. 1/3 to 1/2 of cornea limbus ischemia
- **Grade 4** (Poor prognosis)
  - Opaque cornea without view of iris or pupil. More than 1/2 of cornea limbus ischemia

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**Management of Chemical Burns**

- Debride necrotic tissue
- **Frequent ART**
- Bandage contact lens
- Quinolone: 1 gtt 6-8x/day (prevents infection)
- Prednisolone phosphate: 1 gtt q 1-2 hr while awake (reduces inflammation)
- Vitamin C: 1-2 gm po QD (reduces corneal thinning/ulceration)
- 10% sodium citrate: 1 gtt q 2 hr while awake (chelates Ca++ and impairs PMN chemotaxis)
- Scopolamine 0.25%: 1 gtt TID (reduces pain/scarring with AC inflammation)
- 10% Mucomyst (N-acetyl-cysteine): 1 gtt 6x/day (mucolytic agent and collagenase inhibitor)
- Oral pain meds
- Dexamethasone 100 mg po bid (collagenase inhibitor)
- Glaucoma gtt/oral diamox if IOP elevated
- Significant injury may require admission
Pearls - Prevention is KEY!!!

- Know the potential eye safety dangers
- All chemical injuries should be lavaged immediately
- Extent of damage is dependent on concentration and pH of acid or base
- Eliminate hazards before starting work
- Use protective measures

Case #2: Pencil Fighting

- 13 year old AA male
- Stuck in the eye with a pencil
- Couldn’t open his eye

Open-Globe Injuries

- Full-thickness wound of the eyewall
- Rupture – Caused by blunt object increasing IOP, wound is an inside-out mechanism and not necessarily at the impact site
- Laceration – Usually caused by a sharp object, wound is an outside-in mechanism at impact site
- Penetrating – single entrance laceration
- Perforating – Two wounds caused by the same object

Open Globe

- Check VA - reduced
- Seidel’s sign
  - NaF stain
- Displaced pupil
  - Expelled contents
- Non-reactive pupil
- Low IOP
- Poor reflex
- Hyphema

Case #3: Weekend Call

- 64 yowm c/o decreased VA OS, watery eye, no pain
- Hit head on corner of the bed last night
- Went to sleep hoping it gets better
- Used ATs for relief
- Ocular Hx: Cataract surgery OU, PKP OS 2005

Ruptured Globe

Photo Courtesy of Tom Joly, MD, PhD
Treatment for Open Globe Injuries

• Protect the eye with fox shield
• Oral antiemetics to prevent Valsalva maneuvers
• Administer sedation and analgesics PRN
• Avoid topical eye solutions

Closed-Globe Injuries

• Closed-globe injuries
  — No full-thickness wound of the eyewall
• Contusion
• Laceration
• Superficial foreign body

Contusion

• Need to get eye open
  — Will dictate urgency of consult
• Check VA
• Asses lids and globe for debris or lacerations
• Check pupil response (round pupil)
• Red Reflex?
• Do eyes move well together?
• Instill Fl to check for abrasions
• Check IOP if all else is clear
• Palpate bony orbital rim checking for tightness or crepitus (orbital emphysema)

Black Eyes

• Severe
• Palpate orbital rim
• Treatment
  — Ice packs
  — Pain meds
  — Rest

Sub-Conjunctival Hemorrhage

• No sx other than redness
• Cause:
  — Valsalva: cough? Heavy lifting?
  — Trauma: rubbing?
  — Hypertension: check BP
  — Bleeding disorder/meds: warfarin? ASA?
  — Idiopathic
  — Orbital mass: check EOM, retropulsion, IOP

Lid Lacerations

• Check VA
• Difficult to suture because of tarsal plate and margin function
• Refer to ophthalmology
• Tetanus prophylaxis
• Upper lid skin has no subcutaneous fat
### Upper Lid Defects
- Must consider levator/aponeurosis
- NO subcutaneous fat

Excursion of upper eyelid from maximum downgaze to maximum upgaze (12-17 mm)

### Lower Lid
- Lacerated canthus
- Lacrimal drainage system
- Quality reconstruction necessary
- Wound closure can be delayed for up to 3 days with satisfactory surgical outcomes in adults and 12-36 hours in children
  - Can be beneficial to allow swelling to go down, leading to better visualization of tissue re-approximation

### Blunt Trauma
- Proptosis from retrobulbar hemorrhage
- Contusion/sub-conj hemorrhage
- Retinal detachment
- Commotio Retinae
- Traumatic uveitis or hyphema
- Traumatic cataract
- Blow out fracture

### Blowout Fracture
- Check VA
- Base and medial walls of orbit are very thin
- Does not need to be a major trauma
- Look for trapped extra-ocular muscles (reduced versions) - strabismus
- Sunken eye - hypo-ophthalmos
- Infraorbital hypoesthesia
- Diplopia
- Pain on eye movement or nausea

### Repair?
- Within 2 weeks
  - Symptomatic diplopia within 30° of primary gaze
  - Muscle entrapment (prevent ischemia and necrosis)
  - Fracture greater than 50% of orbit floor
  - Displaced orbital rim fracture
  - > 3mm of enophthamos, significant hypo-ophthalmos
- Monitor
  - Diplopia outside central 30°
  - Modest isolated fractures
  - Improvement over first 2 weeks

### Orbital Trauma in Children
- Trap door orbital floor fractures are very common
  - More elastic orbits
  - More common to get muscle entrapment
- Evaluation for repair typically in 5-7 days vs 2 weeks for adults

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[Photo Courtesy of Tom Joly, MD, PhD]

[http://www.opt.indiana.edu/ce/big10/02.htm](http://www.opt.indiana.edu/ce/big10/02.htm)
Pearls

- Initial restriction in ocular motility is often secondary to orbital edema
- If no entrapment on CT, re-evaluate after edema resolves

Corneal Foreign Body

- Remove if visible and not completely penetrating
- Always document depth of FB
- Stain cornea with NaFl
- Anesthetize eye for patient comfort and to allow a better view.

Case Example

- 26 year old White Male
- Prisoner in Alabama
- Chipping cell bars with file while prison guard is blowing himself up
- Occurred 2 weeks ago
- Feels something hit his eye

Initial Presentation

- VA: OD = 20/30 OS=20/25
- Right eye ciliary flush
- Scattered subconjunctival hemorrhage
- Mild traumatic iritis
- Counseled vision should return
- Rx with Atropine and Pred Forte drops

Two Weeks Post Injury

- Persistent foreign body sensation and redness
- VA: OD = 20/30 OS=20/20
- Stable iritis
- Dilated exam

IOFB Diagnosis

- Beware of metal on metal
- Careful SLE
- Look at lens closely
- Look at corneal endothelium
- Siderosis
- Dilate
- Gonioscopy
- Transillumination
- B-scan, Plain Film, and/or CT scan
### IOFB Treatment
- Prompt Referral
- Traumatic Endophthalmitis
- Bacillus Cereus: kissin’ cousin to Anthrax
- High risk of NLP and loss of eye
- Immediate Vitrectomy
- Immediate Intravitreal Antibiotics and Vitrectomy within several days
- Chronic IOFB also requires prompt contact with specialist

### Periocular Infection
- Any antibiotic regimen should have adequate central nervous system penetration to minimize the risk of meningitis and cavernous sinus thrombosis
- Systemic steroid use is controversial and should only be used after sufficient antibiotic loading and on immunocompetent patients

### IOFB Treatment
- Vitrectomy +/- Lensectomy
- IOFB Removal
- Magnet vs. Forceps
- Where to take out
- Retinal Impact Site
- Laser
- Partial Gas-Fluid Exchange
- Posterior Hyaloid Separation
- Not a Simple Procedure

### Clinical Pearls
- Beware of metal on metal
- Prompt referral to retinal specialists
- Potential severe complications
  - Retinal Tear
  - Retinal Detachment
  - Traumatic Endophthalmitis
  - Siderosis

### Corneal Lacerations
- Seidel test
- Observation versus surgical repair
  - Size
  - Depth
- Severe trauma
  - Iris prolapse
  - Scleral laceration
  - Cataracts
  - Hyphema

### Corneal Abrasions
- Check VA
- Important to know what abraded the cornea – Organic vs Inorganic
- Did the patient put anything into their eye afterwards?
- Grade the level of pain/light sensitivity
NEVER PATCH!!!
- Patching creates a great anaerobic environment
- Patient can not tell if things are getting worse
- Oxygen speeds healing
- If a patch is needed let an eye doc make the decision
  - Patch for pain until they get into your office?

Fluorescein
- Always instill FI for a suspected corneal abrasion
- Need to use a cobalt blue light to excite the FI
- Be careful with the use of topical anesthetics

Abrasions Treatment
- Minor abrasion require only prophylactic antibiotic and ocular lubricants (topical NSAIDS?)
- Moderate to severe – cycloplegic, oral analgesic, bandage contact lens, 4th Gen Fluoroquinolone
  - Clean up margins?
  - Doxy?

Pearls
- Never prescribe topical anesthetics
- Avoid patching CL wearers and pts who sustained injury from vegetative matter or fingernails
- Consider infectious process in presence of purulent discharge
- Corneal infiltrate is suggestive of infection
- AC reaction is suggestive of infection
- May lead to RCE

RCE Treatment
- Treat abrasion first
- Lotemax with taper X 2 mos
- Muro 128 ung X 2 mos
- Freshkote TID X 2 mos
- Doxy BID X 2 mos
- Restasis???
- Superficial Keratectomy

LASIK
- Any corneal abrasion on a flap is serious.
- Microkeratome flaps can easily come off years after surgery
- Femtosecond flaps incredibly stable, but can still have issues

My Eye Hurts?

- 38 year old male
- Was welding and felt like something was in his eye

UV Keratitis Treatment

- Artificial tears
- Oral analgesics
- Antibiotic if infection is suspected
- No topical anesthetics


Photokeratitis/Snow blindness

- Check VA
- Caused by UVB(C) exposure to the cornea – 320-290nm
- Painful !!!!!!
- Superficial punctate keratopathy about 6 hours after exposure (corneal sun burn)
- Typically self limiting
- Welders flash, tanning beds, skiing, desert, sailing

Travel Troubles

- 46 YOWF, hit OD with a bungee cord from baggage
- Half of her vision blacked out on nasal side, pain, tenderness, swelling
- VA came back in 15 minutes
- Happened at 8:30am

Traumatic Hyphema

- Sports Injuries account for 60% of hyphemas
- Complications
  - Elevated IOP
  - Posterior Synechiae
  - Peripheral anterior synechiae
  - Corneal blood staining
  - Optic atrophy
  - Angle recession glaucoma (usually >180º)

Traumatic Hyphema

- Draw the level of the clot and record the level of free cells
- Tear usually occurs at the anterior aspect of the ciliary body in the angle
- Uncomplicated hyphemas usually last 5-6 days
## Traumatic Hyphema

**Red blood cells in the TM**

**Immediate Rise in IOP**

**Ghost cell glaucoma**

**IOP rise weeks post-trauma**

**Angle recession glaucoma**

**IOP rise years post-trauma**

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### Purpose of Hyphema Treatments

- Prevent IOP increase
- Prevent secondary hemorrhage
- Prevent corneal blood staining
- Sickle cell anemia complicates things

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### Traumatic Hyphema Treatments

**Elevate head and shield the eye**

- Bed rest
- Pain – acetaminophen (no Aspirin)
- Cycloplegics – decrease risk of posterior synechiae
- Miotics – increase surface area for iris reabsorption
- Steroids – immediate use is debatable
  - Use after 4-5 days likely helpful to reduce risk of scarring
- Treat IOP >30 mm Hg

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### Traumatic Hyphema Treatments

- Aminocaproic (antifibrinolytic) acid may be used for larger hyphemas or with increased risk of re-bleeds
  - May require inpatient care due to side effects
- Oral osmotic agents can be used to control IOP
  - Debatable whether any topical medications have a therapeutic advantage in the acute phase
- Consider referral for hyphemas greater than 75%

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### Pearls

- Rebleeding is a common complication of hyphema as the blood clot stabilizes and retracts
- Elevated IOP can occur in hyphema patients
- Sickle cell patients are at special risk for IOP elevation
  - Avoid CAI which can cause metabolic acidosis and worsen sickling

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### Angle Recession

- Important late complication of ocular trauma
- IOPs may remain normal for years to decades before becoming severely elevated
- Patient education to the importance of future care
- Fellow eye increased risk of POAG
Iridodialysis/Cyclodialysis

- Iridodialysis: iris torn from scleral spur
- Cyclodialysis: ciliary body torn from SS

Dislocated IOL

- Consider in High Risk Patients
  - Pseudoexfoliation
  - Marfan’s
  - Trauma
- Unrecognized zonular dehiscence
- Unrecognized tear in posterior capsule
- Treatment
  - Refer to surgeon if patient symptomatic
  - Repositioning or IOL exchange

Traumatic Uveitis

- Check VA
- Light sensitive
- Ciliary flush
- Decreased VA
- Decreased pupil response
- Sub-conj hemorrhage

Traumatic Cataract

- Signs
  - Proptosis
  - Increases IOP
  - Ecchymosis
  - Ophthalmoplegia
  - APD
  - Disc swelling due to compressive optic neuropathy
  - Central retinal artery pulsation

Retrobulbar Hemorrhage

- Signs
  - Proptosis
  - Increases IOP
  - Ecchymosis
  - Ophthalmoplegia
  - APD
  - Disc swelling due to compressive optic neuropathy
  - Central retinal artery pulsation

- Symptoms
  - Eye pain
  - Diplopia
  - Vision loss
  - Reduced ocular motility
  - Proptosis
Orbital Compartment Syndrome

- Diffuse accumulation of blood throughout the intraorbital tissues due to surgery or trauma
- Pain and decreased VA
- Proptosis, distortion of globe, optic nerve stretching
- Build up of volume is only held back by medial and lateral canthal tendons

Traumatic Optic Neuropathy

- Visual outcome is poor
  - Regardless of treatment (high dose corticosteroids, optic nerve sheath fenestration, or optic canal decompression), outcome is poor
- RAPD presence is the most useful diagnostic test

Pearls

- In absence of severe retinal pathology, APD is highly suggestive of optic nerve pathology
- With head trauma, concussive forces can be directed to the optic canal
  - Damage secondary to compression from hemorrhage or edema or lacerated by fractured bone
- Patients with traumatic optic neuropathy often have other head or neck injuries

Traumatic Retinal Damage

Finding the tear

- If superior RD not crossing vertical midline
  - Tear will be within 1-2 clock hours of most superior point of the RD
- If superior RD crossing vertical midline, or total RD
  - Tear will likely be near 12:00
- If inferior RD
  - Tear usually around 6:00, lying more to the side of the higher detached side

Commotio Retinae

- Energy is transferred to the opposite side of the globe.
- Inflammation will usually be on posterior nasal retina
Choroidal Rupture

- Caused by trauma which compresses the eye on its anterioposterior axis and expands it on its horizontal axis
- Rupture in Bruch’s membrane, RPE and choriocapillaris
- Found temporal to and concentric to optic disc
- Accompanied by subretinal hemorrhage
- No nerve fiber bundle VF defects seen
- CNV uncommon complication

Valsalva Retinopathy


Purtscher’s Retinopathy

- Due to severe compression injury to the head or chest
- Complement-activated coagulation of leukocytes and other microemboli that occlude retinal capillaries
- Unilateral or Bilateral
- Poor vision from macular infarction and/or optic nerve dysfunction

An Officer and a Fireman

- 34 year old White Male
- Prison Guard who makes custom knife sheaths as hobby
- Requires heating of plastic polymer to bond with knife base
- Decides one Saturday that this may work well for a lighter

Initial Presentation

- Va: OD = 20/300 OS=20/30
- First degree burns right periorbital region
- Scattered subconjunctival hemorrhage OD
- Mild Traumatic iritis
- Counseled vision should return

Two Months Post Injury

- Has new hobby
- Avoiding firearms and other things that can go boom at work
- Still blurred OD
- Va: OD = 20/300 OS=20/30
- Counseled vision should return
- Presents for second opinion
Differentials
- Trauma
  - Hemorrhage
  - Commotio
  - Hole
- Solar
- Vascular
  - BVO
  - JFT
  - Coat’s
  - CNVM
  - CRAO
- Inflammatory
  - MFC, POHS
  - PIC
  - CNVM
- Genetic
  - Pattern Dystrophy
  - Neuronal Storage
  - Angioid Streaks
  - Early Stargardt’s

Macular Hole Diagnosis
- Physical Exam
- OCT
- Watske-Allen
- HVF’s 10-2
- IVFA not indicated

Macular Hole Treatment
- Spontaneous hole closure rate 1%
- Vitrectomy hole closure rate 80-85%
- Post vitrectomy cataract 70% at 1 year
- Post vitrectomy RD 3% at 1 year
- Post vitrectomy VF defect in 10-15%
- Risk of fellow eye hole 10% without PVD
- Risk of fellow eye hole 2% with PVD

Clinical Pearls
- Macular Pathology may be difficult to detect
- Compare to fellow eye
- OCT is helpful
- Watske-Allen is helpful

Pearls
- Consider retinal tears or detachment in presence of pigment or RBC in vitreous
- Traumatic macular holes have been known to spontaneously close with restoration of good vision