Ocular Trauma and Imaging

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Incidence:

• 2.4 million eye injuries each year

• 40,000 significant vision loss
United States Eye Injury Registry

- 80% male average age: 30
- 21% work related
- 39% home
- 12% auto
- 12% sports and recreation
- 15% violence

- www.USEIRonline.org
Urgencies

• Penetrating injury of the globe
• Angle closure glaucoma
• Corneal foreign body
• Acute retinal detachment
• Hyphema
• Lid laceration
Semi-Urgent Situations

• Optic neuritis
• Ocular tumors
• Exophthalmos, acute
• Open angle glaucoma
• Old retinal detachment
• Amblyopias in young children
• Blow-out fracture of the orbit
Emergency Office Form

• Name   SS #       DOB
• Address City       Zip
• Phone     home / cell / work

• Condition is related to employment:
  • Employer name and address
  • Authorizing supervisor
  • Workers’ Compensation Insurance Carrier name, address, policy #

• E 849.3
OCULAR EMERGENCIES

• GENERAL CONSIDERATIONS
  • Role of the primary care clinician
  • Preparedness
    • Supplies
    • Equipment
Blunt Trauma to Eye and Adnexa

921.1
Lids and Adnexa

- Lacerations  870.0  99203, (67930)
  - Hydrogen peroxide
  - Simple closure, topical and system antibiotic
  - Tetanus toxoid

- Ecchymosis  921.0

- Ptosis  374.3  92081, 92285

NB: Supplemental procedures must be documented on separate forms.
Tetanus Prophylaxis

• Lacerations >6 hrs old
• Contaminated wounds soil / manure
• Wounds with incarcerated devitalized tissue
• Puncture wounds
• Retained intra-ocular FB
Clostridium tetani

• Under age 7
  • Diphtheria, pertussis and tetanus immunization (DPT)
  • 10 year immunization for clean wound
  • 5 year immunization for “dirty” wound

• Booster
  • Tetanus, diphtheria injection (Td)

• No previous immunization
  • Tetanus immune globulin (TIG) + Td
TRAUMA

• ADNEXA
  • ECCHYMOSIS
  • PTOSIS
  • LACERATIONS
Ptosis
Levator function

- 15 mm Normal
- 8+ Good
- 5-7 Fair
- 4 Poor
TRAUMA

• ANTERIOR SEGMENT
  • CONJUNCTIVA
    • HEMORRHAGE
    • CHEMOSIS
    • CREPTITUS
    • ABRASION
    • LACERATION
TRAUMA

• EOM’S
  • PARESIS (Ⅵ) MOST COMMON
  • HEMATOMA
  • PARALYSIS
Anterior Segment Imaging Protocols

- X-Rays
  - Caldwell
  - Waters
- MRI
  - Contrast vs Non-Contrast
- CT
  - Contrast vs Non-Contrast
Caldwell View
Water’s View
Cases: A Day at My Office!
I Never Thought that Would Happen!

- 56 y/o presented to on call with h/o blunt trauma following explosion in garage at home.
- Oriented x 3
- Pain level: 8-9/10 before sedation
- VA: FC@ 3ft OU
- Ta: MTT OU
- SLE: as shown
- DFE: No view
I Never Thought that Would Happen!

• What next?
A Case of The Unusual Foreign Body Sensation

- DT a 69 y/o male presented with a history of persistent FBS over the last year
- Medical Hx positive fro DM, HTN and Cholesterol
- VA: 20/25 OD/ 20/30- OS ph no change
- IOP: 16/15 mmHg
- SLE: mild SPK OS with atypical foreign bodies
- DFE: Non- contributory
I Thought it Would Go Away!

- 31yoM c/o left eyelid swelling and drooping. No pain, eye redness or discharge. Vision blurry left eye, good vision right eye. No systemic health symptoms. PCP referred for eye consultation.
- POH neg
- PMH neg
- Meds: none
- Allergies: none
I Thought it Would Go Away!

- UCVA OD 20/20, OS 20/20
- PERRL, no APD
- EOM full motilities OU
- VF FTFC OU
- External ptosis OS
I Thought it Would Go Away!

• What next?
I Thought it Would Go Away!

- Lacrimal Gland Tumors
  - Inflammation
    - Dacryoadenitis
    - Ductal Cysts
    - Sarcoidosis
    - Orbital Pseudotumor
  - Neoplastic
    - Epithelial Tumors
    - 50% benign, 50% malignant
I Thought it Would Go Away!

- Benign Lesions
  - Pleomorphic adenoma
  - Lymphoid hyperplasia
  - Oncocytoma
  - Occur in 4\textsuperscript{th}-5\textsuperscript{th} decade
I Thought it Would Go Away!

- Malignant Lesions
  - Adenoid cystic carcinoma (50% of cases)
  - Adenocarcinoma
  - Squamous cell carcinoma
  - Mucoepidermoid carcinoma
  - Lymphoma
  - Occur in 3rd decade, sometimes teenagers
  - 15 year mortality rate is 75%
Anterior Chamber Trauma

• HYPHEMA
• IRIDODIALYSIS
• ANGLE RECESSION
• PUPILLARY ABNORMALITIES
• INFLAMMATION
• LENS SUBLUXATION
Hyphema

• Most often caused by trauma
  • Disruption of ant / post ciliary artery complex

• Differential
  • Iris neovascularization
  • Post surgical
  • Melanoma
  • Clotting disturbances
  • Anticoagulant medications
  • Leukemia
Hyphema

• Grading
  • I \(\frac{1}{3}\) full
  • II\(\frac{1}{3} - \frac{1}{2}\)
  • III \(\frac{1}{2} - \frac{3}{4}\)
  • IV full

• Image with photos (Cell phone)
Hyphema

• Absorption
  • Increasing IOP causes vasospasm
    • Stops initial bleed
    • Starts fibrin – platelet clot
  • Clot stabilizes in 4-7 days
    • No fibroblastic activity or neovascularization

• Plasminogen – plasmin – activates fibrinolytic
• Clears through the TM
Hyphema

• Office procedures
  • VA, IOP, A/C status, blood staining
  • QD
  • First 4 days

• Defer gonio 1 month
• Defer scleral depression 1 month
Hyphema: Treatment Protocol

• Hospital vs home
  • Compliance
  • Risk of re-bleed
  • Uncontrolled glaucoma
  • Frequent office visits

• Keep head elevated
• Bed rest vs moderate activity
  • Grade I only
Treatment Protocol

• Shield
  • FULL TIME use until hyphema clears
  • Avoid further injury

• Aspirin / NSAID’s
  • d/c until hyphema clears

• Cycloplegia
  • Relax C.B., reduce inflammation, increase comfort
  • Compress iris vessels, prevents stress from movement of iris
Treatment Protocol

• Topical steroids
  • Disruption of blood aqueous barrier
  • Some component of uveitis
  • Taper with reduced inflammation

• Antifibrolytic agents
  • Clot stabilization for extended healing
  • Reduce secondary heme
  • Aminocaproic acid
    • inhibits plasminogen to plasmin: decrease fibrinolysis
    • 50 mg/Kg PO q4h 5 days (max 30 g qd)
    • New topical formulation
Hyphema : Sequellae

• Re-bleed

  • 3.5% to 38%
  • 2-5 days after initial bleed
  • Increased incidence with increased severity of initial bleed
Sequellae

• Corneal blood staining
  • Increases with large hyphema and elevated IOP
  • Worse with extended clot duration
  • Increases with endothelial compromise
  • Erythrocyte breakdown products absorbed by stromal keratocytes
  • Evacuate clot / decrease IOP
Sequellae

• Glaucoma
  • Up to 25% incidence (size of hyphema)
  • Obstruct TM
  • Direct trauma to angle
  • Potential for pupillary block

• Other
  • Synechiae, cataract, optic atrophy

• 75% 20/50 +
Angle Recession
Presentation

• SLE:
  • Deepen chamber
  • Flattened iris
  • Irregular pupil

• Gonioscopy
  • Compare to fellow eye
  • Localized changes in color / texture
  • Irregular insertion of iris fibers
All of Sudden My Vision Went Bad!

• 58 y/o white female with h/o previous ocular complications in other eye following corneal procedure
• Wears Hybrid CL for Keratoconus
I Just Want to Use My Vision Insurance!

• 48yoF c/o blurred vision both eyes left worse than right for past 6 months. Feels that it is getting worse. Gets headaches after reading. Advised by PCP to have “checked”.
• POH wears eyeglasses
• PMH HTN
• Meds: Lopressor
• Allergies: none
I Just Wanted To Use My Vision Insurance!

- VA: 20/25 OD / 20/40 OS
- EOM; Full but saccades abnormal
- VF: Decreased to FC/OU
- Pupils: 4-4 / 2+ / +MG OS
- SLE: mild NS
- DFE: 0.5-6 C/D OU
- Ta: 12/14

What Next?
Such a Nice Guy!
Present Medical HX

- Eye History
  - LASIK OU (1999)
  - C/O mild blur following procedure
- Past Medical History: hypercholesterolemia
- Family Hx: COAG (father)
- Allergies: seasonal
- Medication
  - Lipitor
<table>
<thead>
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<th>OD</th>
<th>OS</th>
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<tr>
<td>Visual Acuity</td>
<td>20/60</td>
<td>20/50</td>
</tr>
<tr>
<td>Tonometry</td>
<td>16mmHg</td>
<td>15mmHg</td>
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<tr>
<td>Confrontation Fields</td>
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<tr>
<td>Pupils</td>
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<td>EOM</td>
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<tr>
<td>SLE</td>
<td>WNL</td>
<td>WNL</td>
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<tr>
<td>DFE</td>
<td>See photo</td>
<td>See photo</td>
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</table>
Fundus Photo OD
Fundus Photo OS
Such a Nice Guy

• Imaging obtained
  • Orbit / Chiasm & Brain

• 2mm cuts through Pituitary
• MRI revealed 2 cysts measuring 2cm as well as soft tissue densities
• Referred Neurosurgery consult
• Prolactin Level= 27,000 mg/ml (normal level: 3451+/- 1111 mg/ml )
• IGF-1 Level=305 (normal: 121-230
Such a Nice Guy

• Bromocriptine
  • Dose 2.5 mg po qam, 5mg po qhs

• F/U MRI scan
  • shows tumor significantly shrunk
  • Optic Chiasm decompressed
  • Suprasellar mass still present
Visual Field Following
Bromocriptine TX
Vitreo-Retinal Trauma

• HEMORRAGE
• POSTERIOR DETACHMENT (VITREOUS)
• RETINAL TEAR/DETACHMENT
• COMMOTIO RETINAE
• CHOROIDAL RUPTURE
• MACULAR HOLE
Imaging After Blunt Trauma
Burns

940.3
CHEMICAL BURNS

• ACID
  • PRECIPITATE PROTEIN
  • LOCAL DAMAGE

• ALKALAI
  • SLOW CONTINUED DAMAGE
  • DEEP TISSUE INVOLVEMENT
Epidemiology

- 3.6% serious eye trauma are chemical
- 76% male
- 63% industrial premises
- 33% home
- Alkali twice as common as acid
Alkali

• Ammonia: cleaning agents, fertilizers
• Lye: drain cleaners
• Potassium and magnesium hydroxide: flares and fireworks
• Lime: plaster, mortar, cement, whitewash
Acids

• Sulfuric: car battery
• Hydroflouric: gasoline
• Hydrochloric: industrial
• Acetic: household
Mechanism of Action: Alkali

- Increase Ph from hydroxy group (OH)
- Immediate binding with cell wall fatty acids
- Immediate sloughing of epithelium
  - Breakdown of antimicrobial barrier
  - Unable to inhibit collagenase production
  - Destruction of free radical scavenger
  - Increase in sterile and microbial ulceration
Treatments: Emergency

• Topical anesthesia
• Irrigate
  • 2000 ml free flow / 30 minutes
  • 50 ml / hour (15 drops per minute) as needed
• Remove particulate matter
• Debride
• Initiate antibiotics – non-toxic ung
• Initiate anti-inflammatories – Dex q1h
• Cycloplegia
Treatments: Acute

• Ascorbate
  • necessary for collagen synthesis
  • Topical: 10% sodium ascorbate q1h
  • Systemic: sodium ascorbate 2g PO qid

• Citrate (similar to Ascorbate)
  • Topically: 10% sodium citrate qid

• Continue both until re-epithelized
Treatments: Acute

• Bandage contact lens: day 4 +
  • Promotes
    • cell migration
    • Basement membrane regeneration
    • Epithelial / stromal cell adhesion

• Cover with antibiotics
• Amniotic membrane
Epithelial Repair

- Early 8-21 days Migration
  - Corneal epithelium
  - Conjunctival epithelium
  - Limbic stem cell

- Centripetal sliding action on basement membrane
  - Inhibited by inflammatory response
  - Stops at 72 hrs @ polymorphonuclear neutrophils
Treatments: Intermediate (day 8-21)

• D/C Dexamethasone
  • Day 1-10 only
    • unless re-epithelialization complete

• Day 14 interferes with stromal repair
  • Ulcerations

• Remove BCL if re-epithelialized
Epithelial Repair

• Late 21-120 days differentiation
  • Cornea and limbic epithelium
    • Normal, clear, stable
  • Conjunctival epithelium
    • Poor clarity, poor adhesion, neovascularization
Stromal Repair

• Keratocyte re-population from adjacent tissue
  • Collagenase synthesis
  • Collagen
  • Mucopolysaccharide matrix

• Sterile ulcer result from imbalance of the secretions
Treatments: Late (day 22-120)

• Continue medical therapies

• Consider surgical treatments
  • Tarsorrhaphy
  • Autograph transplants
  • keratoplasties
CHEMICAL BURNS

• PRIMARY THERAPY
  • GENERAL LAVAGE
  • SPECIFIC IRRIGATION
  • CYCLOPLEGICS
  • STEROIDS

• SURGICAL
  • PARACENTESIS
  • DENUDEMENT/MUCUS MEMBRANE GRAFT
THERMAL BURNS

• FLAME EXPOSURE
  • TX TO MINIMIZE SHOCK
  • MANAGE SECONDARY INFECTION
  • CICATRICIAL DAMAGE
RADIATION BURNS

• ULTRAVIOLET (10-370)
  • CORNEAL ABSORPTION
  • TISSUE DAMAGE (250-370)
• SOURCES
  • WELDING ARCS
  • SUNLAMPS
• 6-10 DELAY IN PEAK DAMAGE
• Tx?
RADIATION BURNS

• INFRARED
  • “FLASH BURNS”
  • TISSUE DAMAGE
    • ERYTHEMA
    • MIOSIS
    • CELLS/FLARE
FOREIGN BODIES

• CORNEAL/ CONJUNCTIVAL
  • HISTORY
  • TESTING
    • VA (WITH AND WITHOUT PINHOLE)
    • PUPILLARY STATUS
      • ANISOCORIA
      • IRREGULAR SHAPE (OVAL)
FOREIGN BODIES

• EXTERNAL EXAM
• SLIT LAMP EXAM
  • VITAL STAINS
  • A/C STATUS
  • IRIS RETROILLUMINATION
FOREIGN BODIES

• REMOVAL
  • EQUIPMENT
  • ANESTHESIA/BILATERAL
  • SIDEROSIS
  • SUPERFICIAL VS DEEP

• TREATMENT
  • CYCLOPLEGIA
  • ANTIBIOTIC / PATCH/ BCL
FOREIGN BODIES

• PENETRATING
  • LODGED IN TISSUE
    • CAREFUL INSPECTION/ REMOVAL
    • REFERRAL

• PERFORATING
  • HISTORY IS CRITICAL
  • TRIAGE/REFER
Foreign Body Management

• Standard x-ray protocols
  • AP / Lateral
  • CT Scan
  • MRI ?

• When/ Where/How and Why?
CRAO

• CLINICAL PRESENTATION
  • PARTIAL VS COMPLETE
  • DURATION = LOSS OF VA

• TREATMENT
  • IOP LOWERING
  • “PAPER BAG”
  • ASA
  • OCULAR MASSAGE
  • PARACENTESIS
ANGLE CLOSURE

• TYPES:
  • ACUTE
  • SUBACUTE
  • CHRONIC

• SYMPTOMS
  • HEADACHE
  • DISCOMFORT/PAIN
  • NAUSEA
ANGLE CLOSURE

• SIGNS ACUTE
  • MID-DILATED
  • INCREASED IOP
  • CORNEAL EDEMA
  • CIRCUMLIMBAL ENGORGEMENT

• SIGNS SUBACUTE
  • CELLS/FLARE
  • GLAUCOMFLECKEN
  • LOW IOP ?/ PAS
ANGLE CLOSURE

• MEDICAL
  • PHARMACOLOGIC THERAPY
  • SURGICAL TREATMENT
My Vision is Funny Since I had My Baby!

- POH neg
- PMH obesity
- S/P Prima Gravis x 12 months
- Meds: none
- Allergies: seasonal
My Vision is Funny Since I Had My Baby!

- UCVA OD 20/20, OS 20/20
- PERRL, no APD
- EOM full motilities OU
- VF: 30-2 occasional non-specific loss
- IOPs OD 15, OS 15 @ 3:30PM
- External weight 198 lbs, BP 131/84