Ophthalmologic Emergencies

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Ophthalmologic Emergencies
Eye injuries

• Life threatening issues take precedence over eye injury
• Integrity of globe must be ensured
• R/o serious injuries before initiating therapy
History

• Vision status prior to injury
• Nature of injury
  – How hard was eye struck
  – What type of object
  – Suspected bacterial contamination
  – Potential foreign bodies
• Foreign body sensation
• Contact lens wearer
• Animal bites
Examination

• Attempt to assess visual acuity
  – limited by pain, lid swelling, noncompliance, head injury

• Test for light perception if unable to open eyelids

• If nonverbal, note reflex contraction of orbicularis oculi with bright light
Examination

• Test visual acuity in each eye **independently**
  – Count fingers – note maximal distance
  – Identify letters
  – Pinhole test – if vision is improved, poor vision is unrelated to trauma, the patient needs glasses
Examination

Figure 114.4. Cotton swabs used to separate infant eyelids.

Ophthalmologic Emergencies
Examination

• Stepwise approach
  – periorbital tissues
  – eyelids
  – movement of eye muscles
  – pupils – shape, irregularities, size
  – anterior chamber – clear or cloudy
  – document red reflex
  – fundus
Anatomy of the Eye

Ophthalmologic Emergencies
Unequal Pupils

- Trauma
  - Direct
  - Head injury
- External agents – atropine
- Tumor
- Normal variant
  - Look at old photos
Anterior Segment Injuries

- Corneal and conjunctival injury

- Conjunctiva – a mucous membrane
  - Bulbar conjunctiva –
    • covers sclera and joins with cornea at the limbus
  - Palpebral conjunctiva –
    • lines eyelids
    • a.k.a. tarsal conjunctiva

Ophthalmologic Emergencies
Cornea

- Avascular mucous membrane
- Transparent
- Anterior continuation of sclera
- Consists of several layers –
  - Epithelium
  - Stroma
    - Bowman’s membrane
    - Basement layer
  - Endothelium
- Extensive number of sensory fibers
- Limbus – corneal-scleral junction
Layers of the cornea
Corneal Abrasions Diagnosis

- Abrasions due to trauma
  - Pain
  - Red eye
  - Photophobia
  - Tearing
  - Drop in visual acuity due to loss of smooth reflective surface
  - Blepharospasm
Corneal abrasions
Diagnosis

• Fluorescein
  – Specialized dye,
  – Stains irregularities in the surface of the epithelium
  – De-epithelialized areas stain bright green with fluorescein and cobalt blue light
  – Slit lamp to determine depth
Types of Corneal Abrasions

• Linear
  – Suspect retained foreign body under upper eyelid

• Cloud-shaped
  – Suspect foreign body with rubbing
Corneal abrasion with fluorescein staining

Fig. 123 Corneal abrasion.
Topical anesthetics

- Diagnostic as well as therapeutic
  - Cause of the pain must be a problem at the surface, reassurance
- Proparicaine and tetracaine most commonly used
- May increase compliance in young children
- Equivalent anesthetic potency
- Prolonged application may cause complications and corneal damage
Topical Anesthetics

• Proparicaine
  – 0.5% solution
  – 1 drop, may be repeated,
  – The least irritating of the topical anesthetics
  – Onset 20 seconds
  – Duration 10-20 minutes

• Tetracaine
  – 0.5% solution
  – Stings on application
  – Similar onset and duration
Treatment and Prognosis

• Antibiotic ointment or drops 4 times a day
  – bacitracin, erythromycin, polysporin
• Never use steroids or neomycin
• Most clear in 24-48 hours
• Patching for 18-24 hours has fallen out of favor in recent years
Corneal Foreign Bodies

- Rarer in children than adults
- Often metallic
- Occasionally see sand or grit, plant materials
- Must observe cornea and bulbar conjunctiva, palpebral conjunctiva and inferior cul-de-sac (lower fornix)
- Upper fornix – only visible with double eversion
- Minimize discomfort by having patient look down
- Observe carefully to r/o penetrating injury
- Ferrous foreign bodies – within minutes to hours may leave a ‘rust ring’, permanent discoloration
Lid Everison

Ophthalmologic Emergencies
Double Lid Eversion
Removal of Corneal Foreign Bodies

• Use sterile needle or swab coated with ointment
• Take care not to cause a corneal abrasion (or perforation)
• Treat with antibiotics ointment or drops
Blunt injury

- Subconjunctival hemorrhage
- Hyphema
- Ruptured globe
- Blowout fracture
- Eyelid lacerations
Subconjunctival Hemorrhage

Fig. 150 Subconjunctival hemorrhage.
Subconjunctival Hemorrhage
Causes

- Spontaneous
- Rubbing
- Coughing
- Vomiting
- Elevated BP
- Bleeding disorders
- Trauma
- Surgery
Subconjunctival Hemorrhage

Definition

• Bleeding of small blood vessel under conjunctiva, secondary to an episode of raised venous pressure
• Terminates at limbus (this is an essential point)
• Usually benign, but scary appearance
• Must be able to observe posterior limit
  – its absence may indicate middle or anterior cranial fossa fracture
Subconjunctival hemorrhage

- Note posterior limit
Posterior limit of subconjunctival hemorrhage
Treatment

• Reassurance
• NO rubbing, no exercise or valsalva
• Appears to enlarge over several days
• Normal color changes (warn pt)
  – Purple, green, yellow
• RARELY rebleeds
• Blood gradually resorbed over 2-3 weeks
• Chemosis (conjunctival edema) suspicious for scleral rupture or retained foreign body, as is subconjunctival air
Chemosis
Prognosis

• Excellent return to normal function
Hyphema

• Blood in anterior chamber
• Blood remains fluid in this location; it does not clot
• Trauma to iris root due to shock wave transmitted through aqueous humor
• Often accompanied by intraocular hypertension – glaucoma
Hyphema
Diagnosis

- View of fundus obscured by cloudy ocular media
- Eventually red cells settle to form a layer
- Grading system for severity
- Prognosis is related to amount of bleeding
Hyphema

• Without history of trauma suspect
  – Leukemia
  – Hemophilia
  – Retinoblastoma
  – Child abuse
  – “Fictitious history by the child”
Management of Hyphema

- Rest – no consensus as to how strict or if hospitalization is necessary
- HOB 45 degrees
- Pain control
- Monitoring of intraocular pressure
- No consensus on
  - Patching
  - Cycloplegics (dilating agents)
  - Topical corticosteroids
  - Antifibrinolytic agents
Hyphema

Ophthalmologic Emergencies
Hyphema

Ophthalmologic Emergencies
Prognosis

• Rebleeds usually occur on 2\textsuperscript{nd} to 5\textsuperscript{th} day
• Usually of greater magnitude
• More likely to have increased intraocular pressure
• Secondary hemorrhage leads to worse visual prognosis
• Normal activities may be resumed 1 month after injury
• Potential for glaucoma or cataract development
• Possible permanent pigmentary changes to cornea
Sequelae of Hyphema
Orbital Fractures

• “Indirect orbital floor fracture” more commonly known as “blowout”
  – Specific type of orbital fracture with intact orbital rim

• “Direct orbital floor fracture” is associated with an orbital rim fracture
  – Takes significantly more force
Opthalmologic Emergencies

Blowout Fracture

• Caused by direct blow through closed eyelids
• Object larger than the orbital opening – ball, fist, dashboard
• Pressure wave transmitted through orbital contents to walls
• Two weakest points
  – Floor nasal to infraorbital groove
  – Medial wall of orbit

Ophthamologic Emergencies
Normal anatomy of the Eye

- Orbit – 4 walls, converge posteriorly
- Medial walls of left and right are parallel, with nose in between - lamina papyracea
- Lateral and medial walls at 45 degree angle
- Volume is 30 ml in adult
- Eyeball occupies 1/5 of space
- Remainder is fat and muscle

Ophthalmologic Emergencies
Anatomy of the orbit

Ophthalmologic Emergencies
Blowout Fracture of Orbital Floor

Figure 24–3. Schematic to demonstrate a blowout fracture of the orbital floor. The dotted line indicates the normal position of the globe. The small opening into the maxillary sinus entraps the inferior rectus and oblique muscles. (From Catalano, R. A. [ed.]: Ocular Emergencies. Philadelphia, W.B. Saunders Co., 1992.)
Blowout Fracture

• Clinical signs
  – Limitation of upward gaze
  – Lid ecchymosis
  – Epistaxis
  – Orbital emphysema
  – Hypesthesia of cheek and upper lip
    • disruption of infraorbital nerve
  – Enophthalmos
    • more common with direct orbital floor fracture
    • may not be apparent until swelling subsides several days later
  – Proptosis suggests orbital hemorrhage
Fig. 120 Restriction of upward gaze due to blow-out fracture.
Blowout Fracture
Diagnosis

- Restricted rotation of globe – due to entrapment of orbital tissues
- Vertical diplopia
- Enophthalmos – usually present, but may be masked by swelling
- “Teardrop sign” – prolapsed tissue through fracture on xray
- Waters view for screening – not used as much now due to availability of CT
- CT with 1.5-2 mm cuts for detail
Blowout Fracture Treatment

- NEVER needs emergent treatment
- Requires waiting several days for swelling to subside to allow for clinical exam
- If severe may require surgery in 14 days if no improvement
- IF visual deficits – suspect retrobulbar hemorrhage, afferent pupillary defect, requires optic nerve decompression emergently
Blowout Fracture
Insertion of Recti
Insertion of Obliques

Ophthalmologic Emergencies
Blowout Fracture

Postero-anterior skull x-ray of blow-out shows right-sided orbital floor fracture with enon of orbital contents into the maxillary antrum, known as the 'teardrop' sign. There is frequently central haziness due to haemorrhage from the tear. In doubtful cases, tomography or CT scan may showing the prolapse. The ethmoidal sinuses medial wall should also be inspected for signs of...
Blowout fracture

Fig. 119  Computed tomography scan of orbital blow-out fracture.
Blowout Fracture

Figure 105.6. Coronal CT scan view of orbits demonstrating right inferior orbital wall fracture with entrapment of inferior rectus and surrounding tissues (arrow).
Anatomy of orbit

Normal Anatomy
- levator palpebrae
  - superioris
- lacrimal gland
- superior rectus
- superior oblique
- lateral rectus
- globe
- medial rectus
- inferior oblique
- inferior rectus
- connective tissue
- maxillary sinus

Blow-Out Fracture
Restricted eye movements

Due to blowout fracture
Penetrating injury

• Anterior segment
  – Iris plugs defect
    • appears as blue, brown or black material protruding through sclera or at corneal-scleral junction (limbus)
  – Teardrop pupil
    • narrowest part points to site of injury
  – Tissue becomes ischemic in several hours
  – Necessitates prompt surgical repair
Penetrating Injury

- Posterior segment
  - Choroid plugs defect so eyeball may not deflate
  - Vitreous gel escapes
  - Viteous hemorrhage
  - May be obscured by subconjunctival hemorrhage
  - Suspect in the presence of chemosis
  - Risk of retinal detachment
  - Ultrasound evaluation
Figure 105.2. Ruptured globe. The scleral laceration appears as a linear brown line on the white of the eye. Also note the teardrop pupil pointing in the direction of the rupture and diffuse hyphema in the anterior chamber.
Ruptured globe

Fig. 199 Ruptured globe through sclera and cornea with prolapse of iris and ciliary body.

Ophthalmologic Emergencies
Ruptured Globe

- Occurs by laceration of cornea or sclera
- May follow blunt or penetrating injuries
- Pupil often appears “tear drop” due to iris plugging the area
- Often eyeball does not appear deflated due to plugging effect
- Maintain high index of suspicion
- Consider the mechanism of injury
- May be accompanied by hyphema
Ruptured globe

- NEVER Patch
- Shield with styrofoam cup
- Prevent crying as much as possible
  - May need mild sedation
- Prevent vomiting
  - Consider antiemetics
- Do NOT instill eyedrops

Opthalmologic Emergencies
Ruptured Globe

- Prevent further trauma due to accidental pressure
- Place Shield over injured eye until able to evaluate so that intraocular contents are not extruded through an eyeball laceration
- Keep child as calm as possible, since valsalva may lead to extrusion of intraocular contents
- Consider mild sedation and antiemetics
- Consider basilar skull fx
Eyelid Lacerations

• Palpebrae - layers
  – Skin
  – Striated muscle (orbicularis oculi)
  – Areolar tissue
  – Fibrous tissue (tarsal plates)
  – Mucous membrane (palpebral conjunctiva)
Penetrating injury
Eyelid Lacerations

Figure 105.7. Lower lid laceration involving tear drainage system. Large arrow indicates lower lid punctum which has been displaced laterally. Thin arrow indicates normal course of canaliculus which drains tears from the puncta to the lacrimal sac located medially.

Ophthalmologic Emergencies
Lacrimal drainage system
Lacrimal drainage system

- Superior puncta
- Lacrimal gland
- Accessory lacrimal glands of Krause and Wolfring
- Inferior puncta
- Superior canaliculus
- Lacrimal sac
- Goblet cells
- Nasolacrimal duct

Ophthalmologic Emergencies
Eyelid Lacerations

• Determine the status of the canaliculi if medial portion of lid is involved
• Take care suturing in area of superior canaliculus and inferior puncta, which flows into nasolacrimal duct
• Tears involving canaliculus should be performed by ophthalmologist after intubation of duct with Silastic tubing
• May be associated with penetration into orbit or intracranial cavity
Eyelid Lacerations

• Medial canthus – junction of upper and lower eyelids may involve proximal canaliculus of nasolacrimal duct
• Lid margin puncta may be displaced laterally
Laceration repair

• Avoid grasping deep tissue (orbital septum) or may result in cicatricial eversion of the eyelid margins
Orbital Septum

- Fascia behind orbicularis oculi muscle between orbital rim and tarsus, barrier between lid and orbit
Repair of eyelid lacerations through margin

**FIG 8–2.**
A, the repair of a vertical laceration that involves the margin of the eyelid. The first suture is placed through the gray line. Any interruption in the margin is first sutured. B, after alignment of the margin of the eyelid the skin is closed with interrupted sutures.
Eyelid Lacerations

Table 105.2. Eyelid Lacerations

Consult ophthalmology if laceration associated with:
- Full-thickness perforation
- Ptosis
- Laceration involving lid margin
- Possible damage to tear drainage system
- Tissue avulsion
- Eyeball injury

Ophthalmologic Emergencies
Intraocular Foreign Bodies

• Scrutinize for small entry site

• High index of suspicion
  – always think of mechanism of injury to predict injuries that may not be immediately obvious
Foreign Bodies

• High-impact, high velocity
• Often metallic
• Tissue coagulation
• Commotio retinae
• Bleeding into cortical gel
• Retinal detachment if ricochets
Foreign Bodies

• Attempt to locate by X-ray
  – Detect by double exposure “eye-mover” lateral xray film
  – Air

• Ultrasound for radiolucent foreign bodies
Foreign Bodies

- Surgical removal
- Fibroblast proliferation
- Siderosis from chemical destruction and ocular absorption of ferrous material
- Occur several months after injury
- Late effects – glaucoma, cataracts
Chemical Burns

• Lye, ammonia and other alkali
  – most ominous
  – Penetrates epithelium immediately
  – Scars

• Acid
  – Does not penetrate stroma or scar
Chemical Burns
Treatment

• A true emergency
• Immediate intervention can improve prognosis
• Irrigation within seconds to minutes is most important factor in mitigating injury
• Do not wait for sedation or pain control
• Irrigate with virtually any IV solution
• 2 liters or 20 minutes
• If pH paper available, until neutralized
• Perform lid eversion to include palpebral conjunctiva
• Debridement – limit to visible particles on surface
Alkali burn

Fig. 140 Sodium hydroxide injury minutes later.

Ophthalmologic Emergencies
Prognosis

• Immediate effects
• Chemosis, edema, hemorrhage, sloughing of corneal epithelium
• Weeks later – corneal necrosis and sloughing
• Late changes – 6 weeks later, cornea remains edematous, melting may occur
• Eventually – healing of cornea with neovascularization, scarring, thinning, poor prognosis for grafting
Healing Alkali Burn

Fig. 141 Sodium hydroxide injury 3 months later.

Ophthalmologic Emergencies
Thermal Burns

- Fireworks
- Adult supervision has NOT been shown to decrease ocular injuries
Contact Lenses

- Corneal abrasions
- Corneal ulcer – white base with surrounding erythema and swelling
- Conjunctivitis
- Breakdown of corneal epithelium and penetration into deeper layers
Contact Lenses

- Need to treat vigorously since always scars
- Broad spectrum antibiotics up to every 15 minutes
- If pseudomonas is involved may perforate in less than 24 hours
- Must refer to ophthalmologist within 12 hours
Corneal ulceration

Fig. 128 Marginal corneal ulceration.
Corneal ulcer with resulting hypopyon
Retinal Hemorrhages

• Always pathologic
• May be found in various layers of the eye
• If no history of trauma investigate other causes
  – Infection
  – Anemia
  – Platelet disorders
• Child abuse highly suspected if less than 3y.o.
Commotio retinae

**Fig. 203** Blunt trauma causing retinal hemorrhage referred to as commotio retinae. Hemorrhage may extend into vitreous.
Prevention

• Protective eyewear for sports
• Polycarbonate lenses
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The End

Thank you for your attention

Opthalmologic Emergencies
Chemosis

- Conjunctiva – a mucous membrane
- Bulbar conjunctiva – covers sclera and joins with cornea at the limbus
- Palpabral – lines eyelids – tarsal conjunctiva
Visual loss

- Severe bilateral loss associated with head trauma causes cortical blindness
- Usually reversible (totally) within a few hours
Visual loss

- Anywhere along optical and neurologic pathways
- Distinguish between central and peripheral
- Techniques to distinguish true traumatic visual loss
- Write name – will be accurate in the face of true injury, while children who are “functionally” blind assume they are also unable to write
- Mirror test – truly blind eyes will not follow, if sight is present will involuntarily follow, reflexive
Ophthalmologic Emergencies
Ophthalmologic Emergencies
Eye Movements

Fig. 26 Lateral orbital view: adduction and abduction is around vertical axis (S–I).

Ophthalmologic Emergencies
Views of ethmoid sinus and nasal lacrimal duct