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Ocular Trauma in Childhood

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GUMS 1400

- Trauma is one of the most important causes of ocular morbidity in childhood

Objectives

- ▶ Be able to perform a basic eye exam.
- ▶ Be able to manage common ophthalmic findings in children.
- ▶ Be able to identify key exam points for ocular trauma

Consideration of points

- ▶ **Difficult nature of evaluation and treatment**
- ▶ **Inadequate patient cooperation or unreliable history**
- ▶ **Force to examine the child's eye, there is a risk of exacerbating the damage**
- ▶ **Defer detailed physical examination of eye until the patient is in the operating room and general anesthesia.**
- ▶ **The potential for the injury to lead to vision loss from amblyopia**
- ▶ **Minimizing the interval between the injury and the restoration of optimal media clarity and optics**
- ▶ **adequate aphakic refractive correction.**
- ▶ **Monocular occlusion following injury should be kept to a minimum**

Get a Good History of the Child's Eyes

Past eye history

- Prior surgeries
- Ocular medications
- Ocular diagnoses
- Use of glasses or contact lenses

Event history

- Onset of complaint and associated symptoms
- Time, place, activity and circumstances of injury
- Treatment rendered prior to arrival

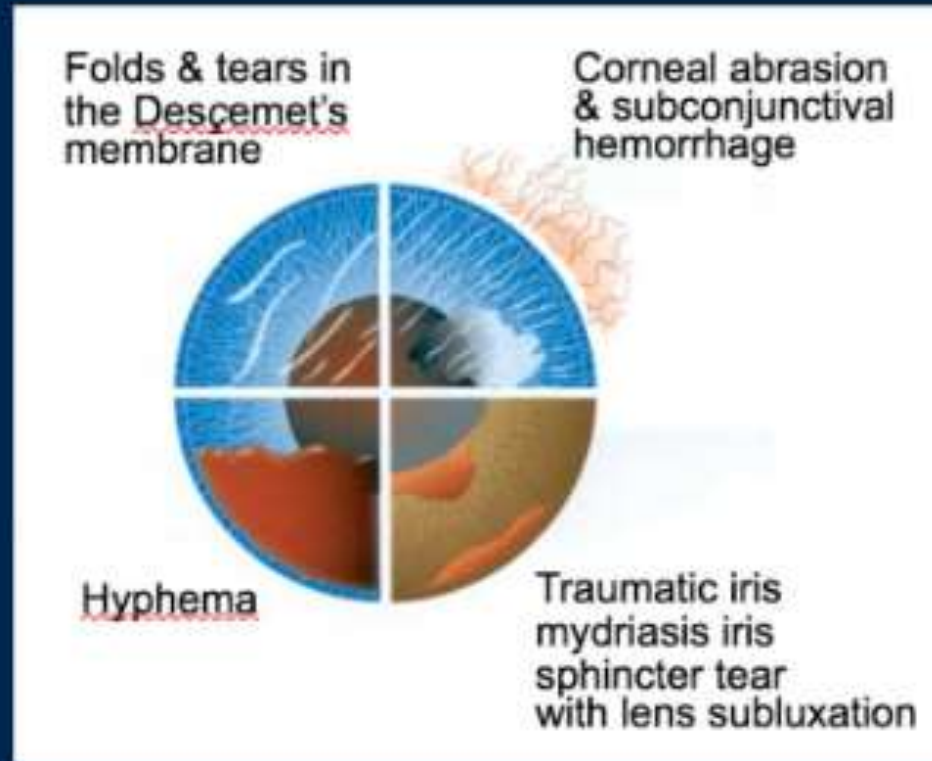
Preexisting visual impairment

- Amblyopia (lazy eye)
- Other causes of visual impairment

- ▶ Accidental Trauma
- ▶ Non accident
- ▶ Although most eye injuries in childhood are accidental or innocently caused by other children
- ▶ A significant portion of them result from physical abuse by adults.
- ▶ The terms used for intentional physical abuse of a child include nonaccidental trauma and child abuse

Eye Infections and Injuries

- Nontraumatic
 - Subconjunctival Hemorrhage
 - Conjunctivitis
 - Keratitis
 - Microbial Keratitis
 - Marginal Keratitis
 - Uveitis
 - Periorbital Ecchymosis
 - Orbital Cellulitis
- Traumatic
 - Subconjunctival Hemorrhage
 - Chemical Burns
 - Iritis
 - Corneal Abrasions
 - Corneal Foreign Bodies
 - Orbital Fractures
 - Hyphemas/Uveitis
 - Lid Lacerations
 - Open Globe



Pediatric Eye Injuries



90% of
BB injuries



67% of
fireworks injuries



46% of
sports-related
injuries



20% of
MVA-related
injuries

Sports-related Injuries

100,000+

patients affected by
sports-related
injuries

40,000

of these patients
account for
eye injuries

13,500

can result in
**PERMANENT
BLINDNESS**

90%

of
these

sports-related
injuries can be
PREVENTABLE

What Activities Lead to Eye Injuries?

	Baseball	26%
Air rifle, BB gun, Paintball, etc.	Other	21%
	Fishing	12%
	Darts	11%
	Hunting	9%
	Tennis	8%
	Bicycling	7%
	Football	6%



Most common types are either

- Penetrating injuries
- Blunt injuries
- Radiation injuries

Serious Pediatric Eye Injuries

70% require major surgery

30% require 2 or more surgeries

25% result in monocular blindness

25% result in severe visual impairment in one eye

Eye Injuries from Trauma

Males are
affected
9x
more often
than females

- Trauma is a leading cause of visual impairment; **usually** unilateral
- A unilaterally blind child is more likely to become blind in second eye compared to bilaterally sighted child



Ocular Examination

- Visual Acuity
 - Monocular assessment at distance or near
 - Check with correction in place i.e. glasses.
 - Depends on age.
 - Nonverbal patients
 - Blinks to light/Reacts to light: develops by GA 31 weeks
 - Fixation: develops by 2-3 mos gestational age.
 - Pictures: Allen chart
 - Letters: HOTV chart/matching, Snellen Chart, crowding bars.



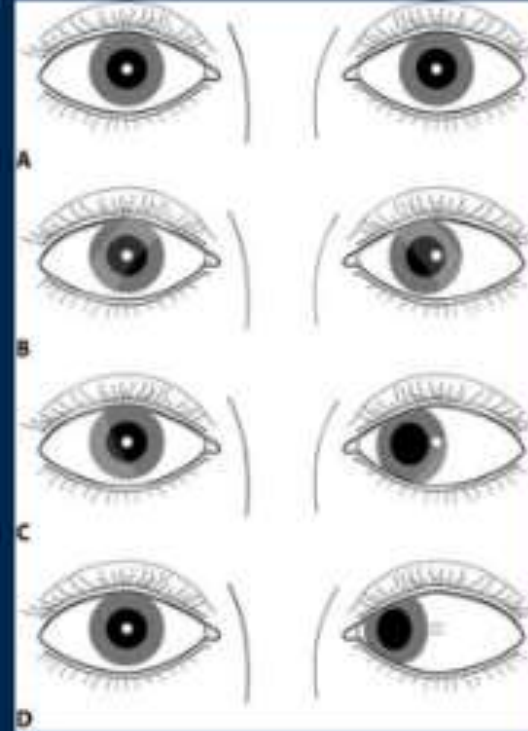
Ocular Examination

- Intraocular Pressure (IOP)
 - Applanation
 - Schiøtz tonometry
 - Tonopen
 - iCare.
 - Tactile



Ocular Examination

- Alignment and Ocular Motility
 - Check Cranial Nerves III, IV, VI.
 - Gross Observation
 - Corneal light reflex testing
 - Hirschberg testing
 - Cover/Alternate cover testing
 - Doll's head if necessary





Ocular examination

- Ocular Examination

- Pupils

- Size, shape
 - Response to direct and consensual light
 - Check for an relative afferent pupillary defect.

- Lids/Adnexa

- Evaluate position of lid, contour, and periocular areas
 - Check for evidence of lesions and edema

- Orbit

- Inspect for symmetry and proptosis
 - Palpate the orbit for “step-offs”



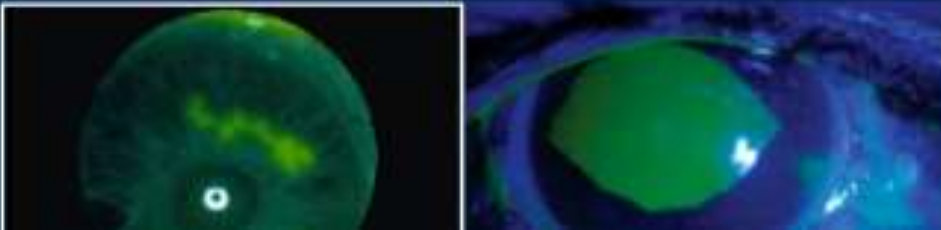
Ocular examination

- Slit Lamp
 - Best for examination of anterior structures.
 - Conjunctiva, Cornea, Iris, Lens, Anterior Chamber.



Ocular Examinations

- Ocular Examination
 - Fluorescein Staining
 - Increased dye uptake indicative of damage to the corneal epithelial cells
 - Can help diagnose the following:
 - Corneal Abrasion
 - Chemical Injury
 - Herpetic Disease
 - Leaking wound



Ocular Examination

- Intraocular Pressure (IOP)

- Applanation
- Schiottz tonometry
- Tonopen
- iCare.
- Tactile



Ocular Examination

- Fundusoscopic exam
 - For evaluation of the optic nerve, blood vessels and retina



Trauma

- ▶ corneal abrasion
- ▶ Corneal Foreign Body
- ▶ Traumatic Iritis
- ▶ Hyphema
- ▶ Eyelid Lacerations
- ▶ Orbital Fractures
- ▶ Open Globe

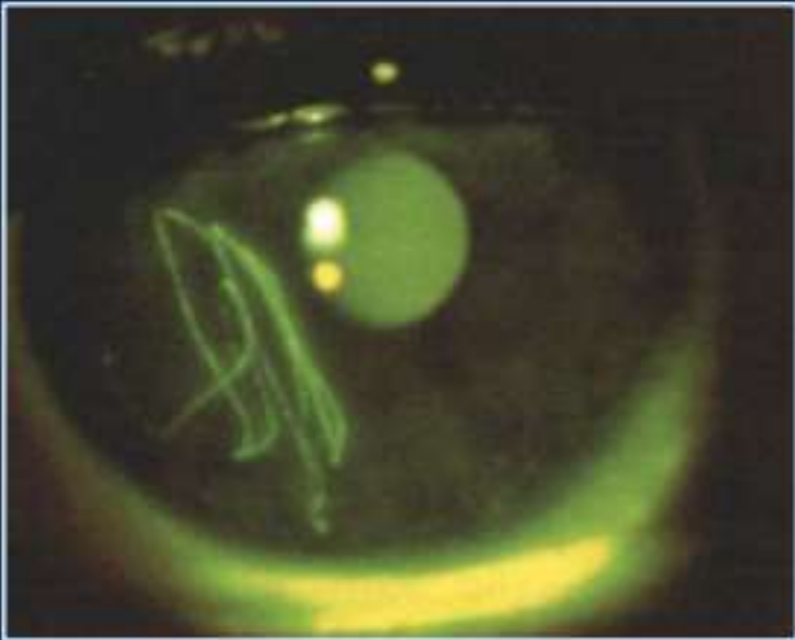
Corneal Abrasions

- Corneal epithelial defect
- Etiology
 - Trauma
 - Contact lens
 - Foreign body
- Photophobia
- Burning eye pain
- Blinking intensifies pain



Corneal Abrasion

- *If you see linear abrasions, suspect a foreign body under the eyelid.



Corneal Foreign Bodies

- History of trauma or sudden onset foreign body sensation/pain.
- Commonly metal for adults, kids (anything)
- Symptoms similar to corneal abrasion.
- Need to rule out open globe.
- Assess depth via slit lamp



Traumatic Iritis: Inflammation of the Iris Following Trauma

- Pupil can be sluggish, dilated, irregular
- Photophobia
- Eye injected (ciliary flush, limbal flush)
- Slit lamp exam: cells in the anterior chamber
- R/O other ocular injuries





Hyphema: Blood in Anterior Chamber

- Due to rupture of iris vasculature
- Evaluate for other globe injuries
- Glaucoma risk
 - check eye pressure
 - Evaluate for sickle cell disease or trait.
- Risk of re-bleeding
- Place eye shield
- Consult ophthalmology ASAP



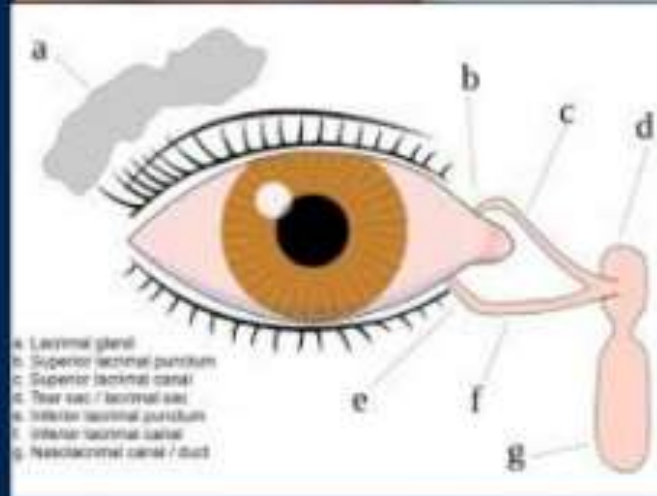
- ▶ Decrease in normal childhood activity is reasonable,
- ▶ Placing a protective metal shield over the affected eye.
- ▶ If parental cooperation is questionable or if the patient has sickle trait, hospitalization for several days after injury,
- ▶ Outpatient management with close follow-up is acceptable.
- ▶ Many ophthalmologists routinely use cycloplegic and corticosteroid drops
- ▶ Pressure-lowering medication is appropriate for eyes known or strongly suspected to have increased IOP.
- ▶ Aspirin-containing compounds should be avoided
- ▶ Nonsteroidal anti-inflammatory drugs can also increase the risk of rebleeding
- ▶ Antifibrinolytic agent (aminocaproic acid or tranexamic acid) orally
- ▶ Topical amino caproic acid
- ▶ Oral prednisolone.

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- ▶ Earlier surgical intervention whenever a total hyphema persists for 4-5 days:
 - Difficulty of detecting early blood staining in a child
 - The risk that corneal staining may cause severe deprivation amblyopia
 - Problems of accurately measuring IOP
 - Sick cell trait or disease

- 
- ▶ Late glaucoma is a potential complication of traumatic hyphema in children, as in adults, and may present with no symptoms.
 - ▶ Gonioscopy can be performed after the eye has healed and the child can cooperate.
 - ▶ Annual follow-up should be continued in children who are found to have angle recession.

Eyelid Lacerations

- Usually due to dog bites, trauma.
- Determine if full vs. partial thickness.
- Determine if involving the lid margin or canaliculus.
- Evaluate for other ocular injury.
- Broad spectrum antibiotic coverage (If animal or human bite cover with Augmentin or Clindamycin)
- Need Tetanus prophylaxis.



Full-thickness eyelid lacerations

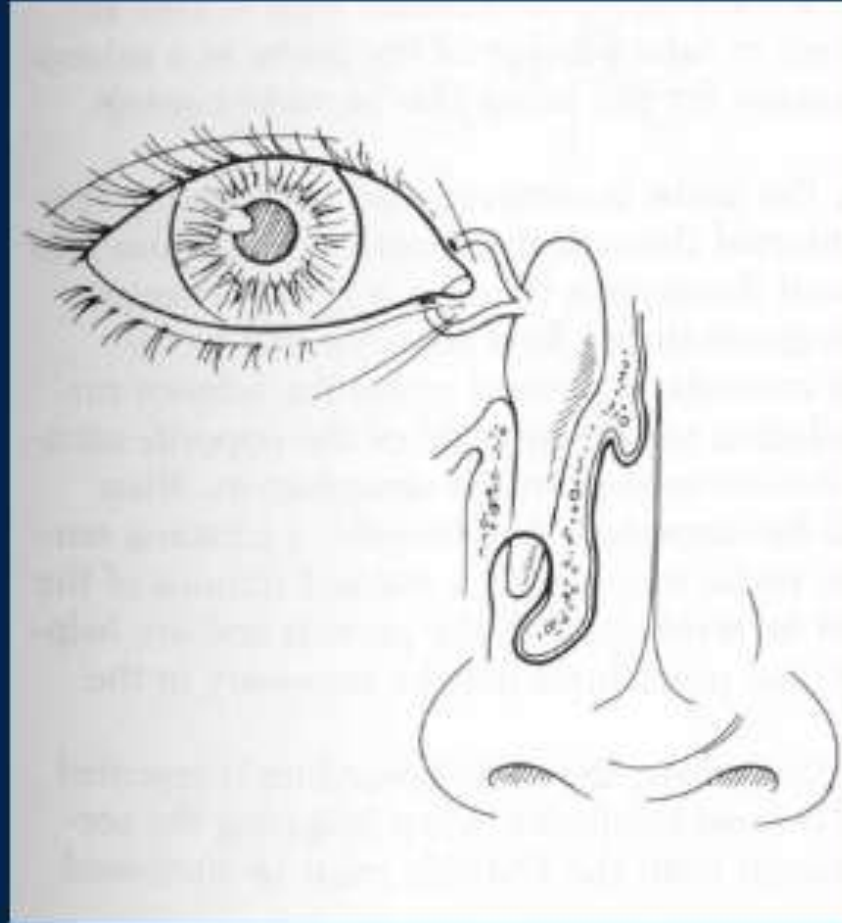
- ▶ Full-thickness eyelid lacerations should be repaired meticulously, especially those involving a canaliculus
- ▶ Working near the eyes with sharp instruments and draping the face to create a sterile field are likely to frighten an awake child
- ▶ Clearly superficial wounds can be repaired in the emergency department.
- ▶ Use of an absorbable suture is acceptable if the physician wishes to avoid the need for removal of nonabsorbable sutures.

Eyelid Lacerations



Always evaluate for possible globe injury.
Always, **Always, Always**

Canalicular Lacerations



Orbital Fractures

- ▶ Blunt facial trauma is the usual cause of orbital floor fractures.
- ▶ Orbital floor fracture is thought to be caused by an acute increase in intraorbital pressure from direct impact that closes the orbital entrance, or by compression of the rim, which results in buckling of the floor.
- ▶ Orbital floor fracture can be part of more extensive fractures of the orbit and midface.
- ▶ In some cases, the mechanism causing floor fractures extends to include the medial wall as well.
- ▶ Injury to the inferior rectus muscle or to its nerve, with resulting weakness

Clinical features

- ▶ Limited elevation or depression.
- ▶ Hypoesthesia in the cutaneous distribution of the infraorbital nerve
- ▶ positive forced-duction.
- ▶ Bradycardia, heart block, nausea, or syncope
- ▶ When the entrapment involves the more anterior portion of the orbital floor or when there is associated injury to the inferior rectus muscle or its nerve, there can also be limited depression
- ▶ Orbital CT Scan high-resolution, multi positional MRI

White-eyed blowout fracture

- ▶ characterized by marked restriction (in both directions) of vertical ocular motility despite minimal signs of soft-tissue injury.
- ▶ This restriction is due to entrapment of the inferior rectus muscle either beneath a trapdoor fracture or linear opening
- ▶ Early surgery, rather than observation, is required in order to minimize permanent muscle and nerve damage.

Management

- ▶ Some clinicians advocate surgical exploration in all cases, irrespective of the results of forced-duction testing.
- ▶ The justification for this approach is :
 - Large bony defects
 - Progressive herniation of orbital contents into the adjacent maxillary sinus
 - Disfiguring enophthalmos.
- ▶ Others recommend waiting for a few days to 2 weeks
- ▶ For these surgeons, the main indication to operate is evidence of restriction with nonrevolving diplopia in primary position.
- ▶ Diplopia immediately after the injury is common and is not necessarily an indication for urgent intervention.

Orbital Fractures

- Periorbital ecchymosis
- Periorbital edema
- Motility restrictions
 - Muscle entrapment
 - Orbital fat entrapment
 - Orbital edema
- Orbital rim “step-offs”
- CT of face and orbits
- Broad spectrum antibiotics
- Consult
 - Face Trauma Team
 - Ophthalmology

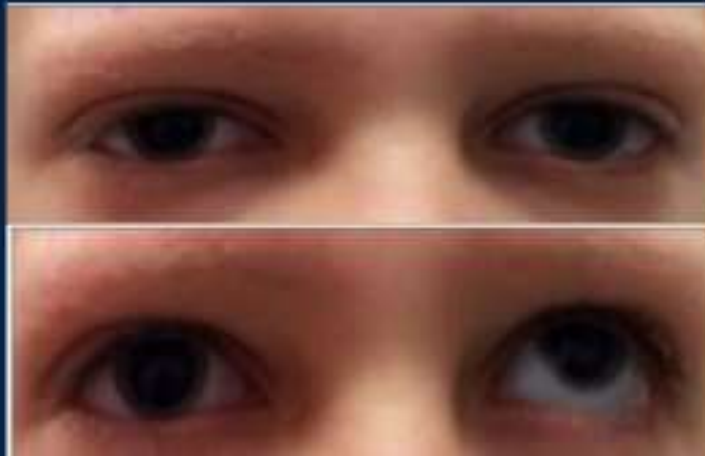
MECHANISM OF FRACTURE



- Force of blow → backward displacement of eyeball → intraorbital pressure increases → fracture in the weakest point of orbital wall

Orbital Fractures

- Be Careful of a white quiet eye in an orbital fracture!
- Trap-Door Orbital Floor Fracture.
- Other signs of entrapment
 - Oculocardiac reflex: Patient's will have nausea and have bradycardia when asked to look up.
 - Increased IOP when looking in the restricted gaze.
- Other emergencies: Roof Fractures



Penetrating Injury

- ▶ The history cannot Exclude the possibility of penetrating injury
- ▶ The anterior segment and fundus must be inspected under general anesthesia
- ▶ Minor signs:
 - Subconjunctival hemorrhage
 - Chemosis
 - Small break in the skin of the eyelid
 - Distortion of the pupil
- ▶ Imaging should be considered if there is suspect an intraocular or orbital foreign body.

Penetrating Injury

- ▶ Corneoscleral lacerations in children are repaired according to the same principles as for adults
- ▶ Corneal wounds heal relatively rapidly in very young patients
- ▶ Fibrin clots in the A/C of can simulate the cataracts lens
- ▶ The clinician should not perform lens removal in the course of primary wound repair unless absolutely certain that the anterior capsule has been ruptured.
- ▶ Even if lens cortex is exposed, postponing cataract surgery for 1-2 weeks, until severe posttraumatic inflammation has quieted

Open (Ruptured) Globe

Suspect if:

- Pupil “peaked” or irregular
- Extensive subconj. hemorrhage
- Decreased vision
- “8 ball” hyphema
- Soft / distorted eye
- Prolapse of ocular contents



Occult Open Globe

Suspect if:

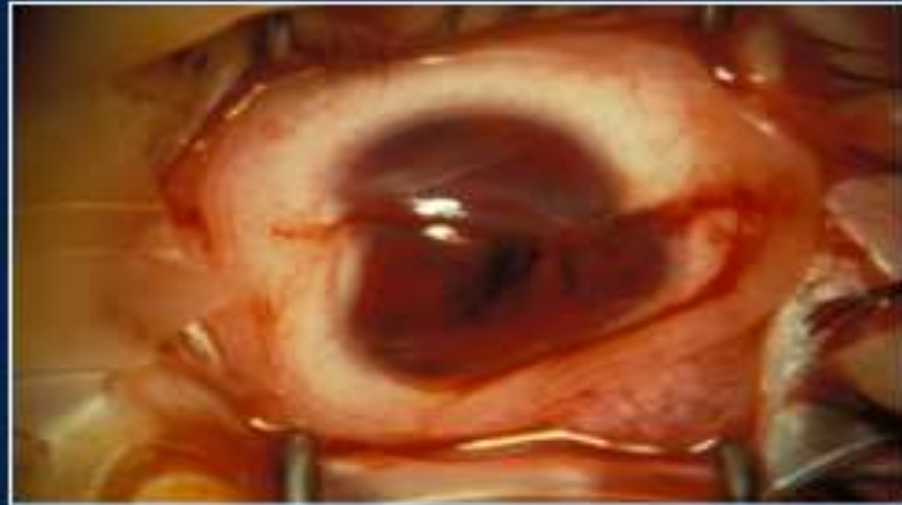
- History consistent with open globe
- VA is markedly decreased
- Eye is soft
- Anterior chamber is shallow
- Pupil is peaked

Open Globe – Initial Rx

STAY CALM

- Place shield over eye
- Elevate head
- Pain and Nausea Control
- Avoid Valsava, pressure on globe, bending, lifting
- Check tetanus status
- Broad spectrum systemic antibiotics
- Imaging, R/O FB

NO TOPICAL MEDS



Important Points

- Eye protection for childhood sports is important
- A pre-participation sports physical can be helpful in identifying patients who may be at increased risk
- Glasses and sunglasses are not enough protection. Safety Sports eyewear that conforms to the American Society for Testing and Materials Standard for selected sports is recommended



Traumatic Optic Neuropathy

- ▶ The optic nerve may be damaged by trauma to the head, orbit, or globe.
- ▶ Vision loss is usually immediate and severe with an afferent pupillary defect present.
- ▶ Initially, the optic nerve appears normal, but it becomes atrophic within 1-2 months of injury.
- ▶ Management is controversial and includes high-dose intravenous steroids and optic canal decompression.

Nonaccidental Trauma

- ▶ Most eye injuries in childhood are accidental or innocently caused by other children
- ▶ A significant portion of them result from physical abuse by adults.
- ▶ Child abuse :
 - emotional
 - sexual
 - neglect
 - physical
- ▶ Suspicion of nonaccidental trauma should be aroused when repeated accounts of the circumstances of injury or histories obtained from different individuals are inconsistent
- ▶ Ocular abnormalities should be documented photographically or with a detailed drawing to use as evidence in court

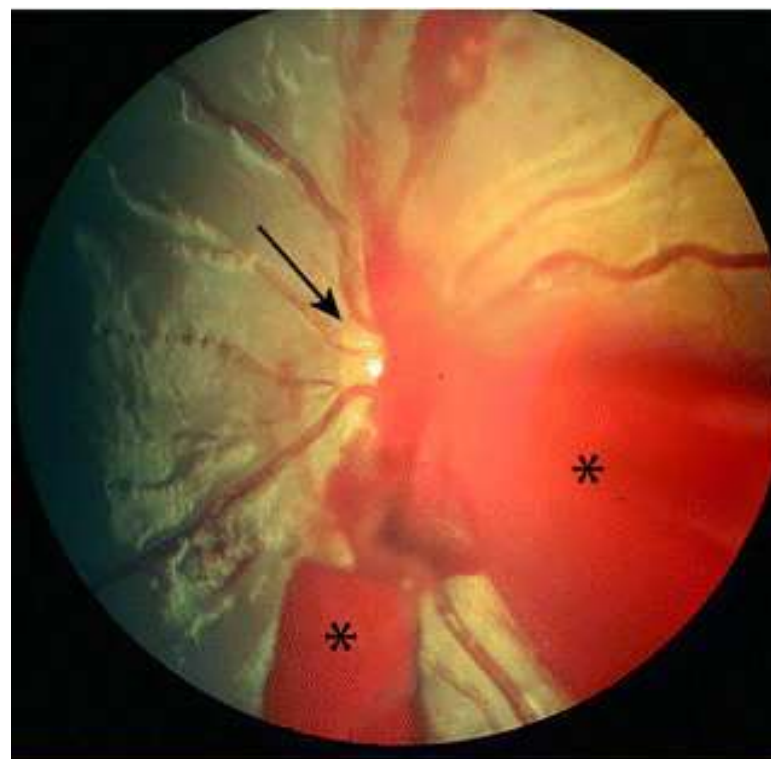
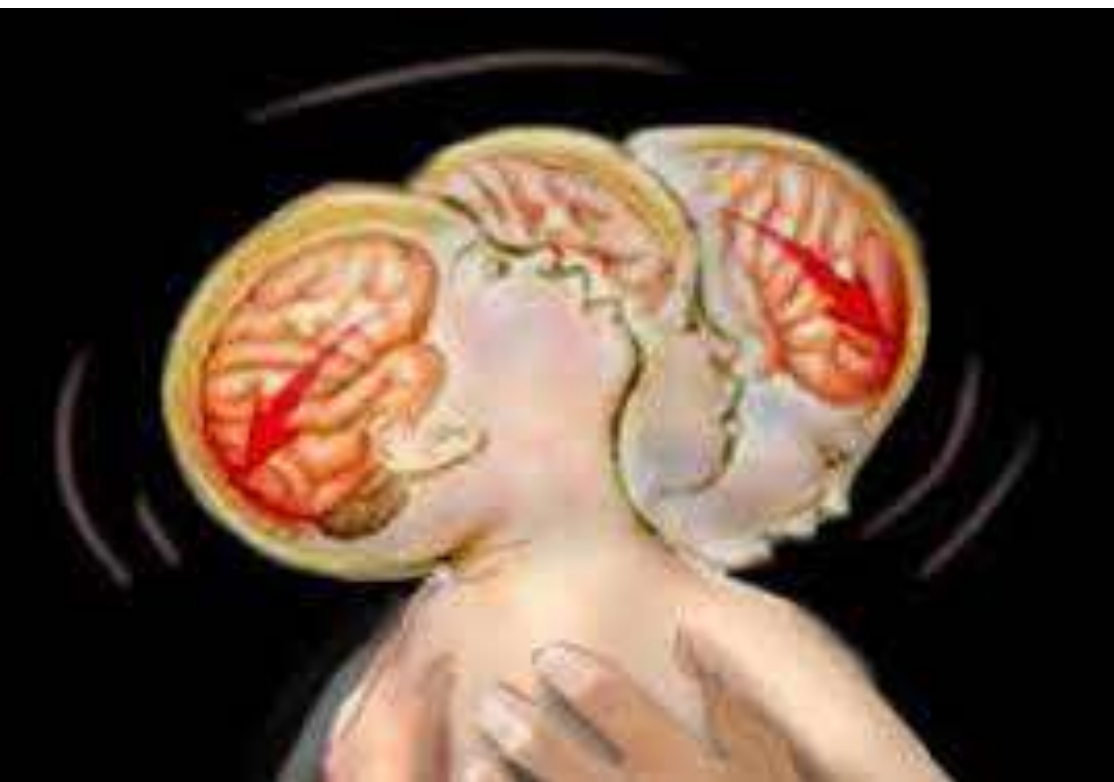
Abusive Head Trauma

- ▶ A unique complex of ocular, intracranial, and sometimes other injuries occurs in infants who have been abused by violent shaking.
- ▶ This is recognized as one of the most important manifestations of child abuse.
- ▶ Although the term shaken baby syndrome is still occasionally used, it has largely been replaced with the terms abusive head trauma ('AHT)

Abusive Head Trauma

Ocular involvement

- ▶ The most common ocular manifestation of AHT, present in approximately 85% of cases, is retinal hemorrhage.
- ▶ Preretinal
- ▶ Nerve-fiber-layer
- ▶ Deep-retinal
- ▶ Sub retinal localization may be seen.



Abusive Head Trauma

Ocular involvement retinal hemorrhage

- ▶ Unilateral or bilateral.
- ▶ Concentrated in or near the macular region
- ▶ Vitreous hemorrhage
- ▶ Retinal hemorrhages usually resolve over a period of weeks to months.
- ▶ Vitrectomy should be considered if there is a risk of amblyopia
- ▶ Full thickness perimacular folds in the neurosensory retina, typically with circumferential orientation around the macula that creates a craterlike appearance
- ▶ Splitting of the retina (traumatic retinoschisis), either deep to the nerve fiber layer or superficial (involving only the internal limiting membrane
- ▶ Retinal folds usually flatten out within a few weeks of injury, but schisis cavities can persist indefinitely.
- ▶ **A striking feature of AHT is the typical lack of external evidence of trauma.**



With greats thanks