Assessment and Interventions of Commonly Encountered Eye Injuries in Children and Adolescents

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6/9/2016

Disclosures

- I have no financial disclosures relevant to this presentation.
Objectives

1. Describe relevant anatomy of the orbit, eyelids, and eye
2. Define primary components of a pediatric eye exam
3. Explain the evaluation and treatment of common pediatric eye injuries
4. List appropriate preventative measures for pediatric eye injuries

Orbital Anatomy

- Frontal bone (orbital surface)
- Sphenoid bone
- Zygomatic bone (orbital surface)
- Ethmoid bone (orbital plate)
- Lacrimal bone
- Nose
- Palatine bone (orbital surface)
- Maxilla (orbital surface)
Internal Anatomy

Internal Anatomy
Extraocular Muscle Anatomy

FIGURE 58-2. The extraocular muscles responsible for eye movement. The medial rectus muscle (not shown) is responsible for opposing the movement of the lateral rectus muscle.

Ophthalmic Examination

- Vision
- Pupil Examination
- Eye movements
- External Exam
- Ophthalmoscopy
Vision

- Depends on age of child:
  - ‘Fix and follow’ – 4-6 months of age
  - HOTV – matching
  - Pediatric optotypes
  - Tumbling E
  - Snellen Chart – letters

> Patch the eye NOT being tested.
Snellen Chart

Hold 40 cm or 16 inches from eyes

Pupils

- P – Pupils
- E – Equal (size)
- R – Round (oval, tear drop, peaked, etc)
- R – Reactive (compare the two)
- L – Light
- A – Accommodation
Afferent Pupillary Defect

Notate: “limited in up-gaze, right eye”

Eye Movements

Up-gaze, down-gaze, right-gaze, left-gaze

Notate: “limited in up-gaze, right eye”
External and Eye Exam

- External:
  - Eyelids
  - Eyelid margins
  - Puncta
  - Canthi

- Eye:
  - Conjunctiva/ Sclera
  - Cornea
  - Anterior Chamber
  - Iris/ Pupil
  - Lens
  - Red reflex (ophthalmoscopy)

Eye Exam

- Penlight
- Direct ophthalmoscopy
Pediatric Eye Injuries

- **Emergent** - Immediate intervention required and immediate transfer to ophthalmologist in hospital setting.
- **Urgent** - Initial intervention helpful and prompt transfer to ophthalmologist (and in some cases hospital setting).
- **Non-urgent** - Initial intervention helpful and possible referral to ophthalmologist or pediatrician for follow-up.

**Emergent Eye Injuries**

- Penetrating injury, foreign body, “open-globe”
  - Consider mechanism of injury
  - Hemorrhagic chemosis
  - Visible corneal or scleral laceration
  - Shallow anterior chamber
  - Eccentrically placed/ “peaked” pupil
  - Hyphema
  - Vitreous hemorrhage
Emergent Eye Injuries

- Penetrating injury, foreign body, “open-globe”

  - Details of mechanism of injury
  - Foreign body - *material* (steel, vegetable matter, copper, iron, etc)
  - Test vision
  - ***Do not allow any pressure on eye***
  - ***No drops/ medicine – nothing in eye***
  - Shield, stabilize any protruding foreign body between gauze – do not remove from eye
  - Immediate transfer to hospital for IV antibiotics and surgery
Emergent Eye Injuries

• Chemical burns
  o Alkali (lye, ammonia) – more serious. Penetrate deep tissues and continue to cause damage after initial injury.
  o Acid (bleach, car batteries, refrigerant) – precipitated proteins form a barrier to further penetration and damage.
Emergent Eye Injuries

- **Chemical burns**
  - Requires immediate irrigation – tap water, normal saline, neutral solution – on site, prior to transport.
  - Brief history and identification of chemical (obtain the container/label).
  - pH testing – irrigation continues until 7.3-7.6 (or continue irrigation until transferred to emergency department).

Urgent Eye Injuries

- **Corneal Abrasion**
  - Sharp pain, light sensitivity, associated with trauma or often contact lens wear.
  - Full assessment
  - Fluorescein staining
Urgent Eye Injuries

- **Corneal Abrasion**
  - Over the counter artificial tears or ointment after examination.
  - Transfer to ophthalmologist’s care for additional evaluation and treatment. Will often continue tears/ointment and add an antibiotic drop.
  - Superficial foreign bodies on the cornea should be removed by a physician.
  - Abrasions usually heal in 24-72 hours but should be monitored for consistent improvement.

- **Blunt trauma**
  - Orbital fracture
    - Protective mechanism
    - Complete exam, focus on eye movements
    - Restriction is common; emergent if bradycardia, nausea, vomiting, pain = white-eyed blowout.
Urgent Eye Injuries

- **Blunt trauma**
  - Orbital fracture
    - Bony step-off/ tenderness, restricted eye movements, significant edema
    - Any suspicion warrants transfer to hospital for evaluation and possible imaging
    - Cool/ ice packs for 20 mins q2 hours
    - No nose blowing
    - Not a surgical emergency; often repaired 10-14 days later with reduction of edema

- **Hyphema**
  - The classic bungee-cord injury.
  - Layered RBCs in anterior chamber.
Urgent Eye Injuries

- **Blunt trauma**
  - Hyphema
    - Full examination
    - Heightened suspicion for “open globe”
    - Shield, limited activity, head of bed elevated.
    - Goal to prevent re-bleed.
    - Blood is resorbed
    - Ophthalmologist monitors intraocular pressure, corneal staining; history of sickle-cell is important.

Urgent Eye Injuries

- **Eyelid laceration**
  - Cutting (sharp object), versus shearing/tearing (blunt object) injury.
  - Full examination
  - Careful assessment of eyelid margin, puncta, canthi.
  - Full thickness or superficial abrasion.
  - Careful assessment of eye for direct injury.
Urgent Eye Injuries

- Eyelid laceration
  - Any finding or suspicion of full thickness eyelid laceration requires physician assessment and orbital imaging.
  - Clean as tolerated with saline or eyewash solution. Saline-moist gauze or over-the-counter ophthalmic ointment to external laceration.

Non-Urgent Eye Injuries

- Blunt trauma
  - Flat, subconjunctival hemorrhage
  - Idiopathic, minor trauma, coughing, emesis, straining, Valsalva
  - Can be irritating, so artificial tears can help.
  - Requires no follow up associated with other systemic, spontaneous bleeding.
Non-Urgent Eye Injuries

- **Superficial foreign body**
  - Flush with saline or eyewash.
  - If visible and not embedded on cornea, use saline-moist cotton tip applicator to gently remove from surface or eyelid.
  - If vision returns to normal, symptoms resolve, and foreign body is no longer visible, student may resume activities.
  - Any decrease in visual acuity or persistent symptoms would warrant ophthalmology referral.

Non-Urgent Eye Injuries

- **Superficial periorbital abrasion or ecchymosis**
  - Minor trauma associated with minimal bruising, pain, or edema can be monitored if there is no worsening of visual acuity and the full eye examination is normal.
  - Cold/ice pack 20 min q2 hours.
  - Periorbital superficial abrasions: apply over-the-counter eye ointment 4 times per day for one week.
Prevention of Children’s Eye Injuries

• Sporting equipment:
  • Ages 4-14, most eye injuries in sports occur in baseball.
  • Ages 15-64, most eye injuries in sports occur in basketball.
  • American Society for Testing and Materials (ASTM ratings).
  • Polycarbonate material or face masks.
    • ASTM F803: Eye protectors for selected sports (racket sports, women’s lacrosse, field hockey, baseball, basketball);
    • ASTM F513: Eye and face protective equipment for hockey players;
    • ASTM F1776: Eye protectors for use by players of paintball sports;
    • ASTM F1587: Head and face protective equipment for ice hockey goaltenders;
    • ASTM F910: Face guards for youth baseball; and
    • ASTM F659: High-impact resistant eye protective devices for Alpine skiing.

Prevention of Children’s Eye Injuries

• Protective eyewear from American National Standards Institute (ANSI) Z87.1 safety standard.
• Avoid projectile toys such as darts, bows and arrows, and missile-firing toys.
• Look for toys marked with “ASTM”, which means the product meets the national safety standards set by the American Society for Testing and Materials.
• Do not allow children to play with non-powder rifles, pellet guns or BB guns.
• When very small children (age 4 and younger) are bitten by dogs, eye injuries occur about 15 percent of the time. The dog is usually a familiar one.
Prevention of Children’s Eye Injuries

- In 2015, fireworks were related to 10,500 injuries requiring treatment in emergency rooms, according to the U.S. Consumer Product Safety Commission. Roughly 1 in 5 of those fireworks injuries harmed the eyes.
- 50% of people injured by fireworks were bystanders and 35% were children.
- Bottle rockets cause every type of eye injury discussed.

References

Questions