I. Introduction

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II. Objectives

- Epidemiology of Ocular Injuries
- Review of Anatomy
- Examination of eye
- Examine eye for trauma and foreign bodies
- Manage chalazia, styes, corneal abrasions, foreign bodies

Ocular Trauma

- “Epidemiological data on eye injuries are still rare or totally lacking in large parts of the world.” J Clin Ophth Res 2016
- 90% are preventable
- Prevalence rates vary a great deal (5-15%)
- Approx 50% work-related
- Non-traumatic ocular illnesses (allergic conjunctivitis) grossly underreported

Occupational Ocular Trauma

- 2002, BLS est 65,000/year
- 2009, BLS est. 2.9/10,000 full time workers requiring 2 or more days off
- NIOSH Work-RISQS query shows 134,000 in 2015

Occupational Ocular Trauma

- Majority are males
- Most are in age 25-44
- Metalworkers at highest risk
- Others: agriculture, construction, manufacturing
- Types of injuries: Abrasions, FB/splash, Conjunctivitis, Burns, Contusion, Open/Penetrating wound,

Risk Factors- Ocular Trauma

- BLS est. 60% fail to wear proper eye protection incl. side/top shields
- Use of tools (unskilled use increases risk 48X)
- Performing unusual task (< 1 day/week)
- Working overtime (3X inc risk)
- Distraction, fatigue, Rushed
- Assoc with sleep duration not stat signif
PPE Effect- Ocular Trauma

- 44% reported eye injury despite PPE (Occ Med, Jan 2009)
- Reported increase use of PPE during work following eye injury (from median 20% to 100%) (Workplace Health Safety, 2012)
- Role of provider education in prevention….Yuge!

Anatomy

- Anatomy of the orbital septum
- Anatomy of the eye and surrounding structures

IV. Elements of Eye Examination

- Visual Acuity
- Pupil light reflexes and corneal reflexes
- Extraocular muscles/cover test
- Visual fields- confrontation and Amsler grid
- Red reflex/ophthalmoscopy
- Biomicroscopy (slit lamp examination)
- Intraocular Pressure (IOP)

Elements of Eye Examination-Office equipment

- Penlight
- Topical anesthetic (tetracaine, ophthaine)
- Dilating drops (Mydriacyl, Cyclogyl)
- Eye pads/ paper tape/tincture of benzoin/ointment (Lacrilube or E-mycin)
- Irrigating solution (Dacrose)
- Fluorescein strips
- Woods light
- Sterile swabs
- Occluder
- Snellen chart/tumbling E chart/Allen cards
### V. Pediatric/Well child eye exam
- **Newborn**
  - Red Reflex: dark room, use ophthalmoscope at 1 foot
  - Pupillary response
  - Observe for eye deviation
  - Observe for congenital cataracts

### Pediatric eye exam
- **Infants (6 months – 3 years)**
- In addition to above:
  - Fixation and Following (CN III, IV, VI)
  - Corneal light reflex (Hirschberg)
  - Cover test

### Pediatric eye exam
- **Children (3 years – 5 years)**
  - Start to use visual acuity tests: Snellen, Tumbling E

### Pediatric eye exam
- **Children age 6 years and older**
  - Use Snellen chart for visual acuity

### V. Developmental landmarks
- **Newborn**: Unable to fix and follow before age 3 months
- **6 months-2 years**: Fix and follow a face, toy, or light
- **3 yrs-5 yrs**: 20/40 or better
- **6 yrs**: 20/30 or better

### VI. Frequency of examinations
- **High risk infants (premature, maternal factors, child abuse, Systemic disease)**
- **High risk children and young adults**
- **African-American over 20 yrs**
- **Hx of eye disease/problems**
- **Hx of systemic illness**
- **Family hx of eye disease (glaucoma)**
Frequency of Examinations

- Age 20 – 39: At least one exam
- Age 40-64: Exam every 2-4 years
- Age > 65: Exam every 1-2 years

Screening methods for refraction in infants and children

<table>
<thead>
<tr>
<th>Age</th>
<th>Methods</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>Newborn</td>
<td>Tonic pupillary light reflex, one goggle</td>
<td>Visual acuity in each eye</td>
</tr>
<tr>
<td>Under age 5 years</td>
<td>Near and far visual acuity, one goggle</td>
<td>Visual acuity in each eye</td>
</tr>
<tr>
<td>ages 5-19 years</td>
<td>Near and far vision, best矫正 near vision</td>
<td>Visual acuity in each eye</td>
</tr>
<tr>
<td>Ages 20 and older</td>
<td>Near and far vision, visual field, subjective refraction</td>
<td>Visual acuity in each eye</td>
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Vision development

<table>
<thead>
<tr>
<th>Vision development</th>
<th>Birth</th>
<th>1 Month</th>
<th>3 Months</th>
<th>6 Months</th>
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<tr>
<td>Pupillary light reflex</td>
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<td>None</td>
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</table>
| Ophthalmia neonatorum

Child with esotropia
VI. Visual Acuity

- Blurred vision is the most common eye chief complaint
- Snellen fraction: Numerator is testing distance, denominator is distance at which object subtends angle of 5 minutes of arc or distance at which normal eye can see the object
- Recorded without (sc) and with (cc) correction at 20 feet (optical infinity) and 16 inches.
- Right eye, left eye, both eyes (OD, OS, OU)

Visual Acuity

- Recording of results:
  - 20/20
  - 20/60 –2
  - 10/400
  - Counting fingers (CF at 5 feet)
  - Hand motion (HM at 5 feet)
  - Light perception (LP) or No light perception (NLP) with or without projection

Visual Acuity

- Macular function can be tested using “auto-ophthalmoscopy” or “entoptic phenomenon”
- Intact macula: patient sees images of retinal vessels

Visual acuity

- Pinhole: If VA is worse than 20/30
- If VA improves, patient has uncorrected refractive error otherwise suspect media opacity, retinal disorder, or optic nerve disease

The Snellen optotype
Visual acuity charts

Notations for recording near visual acuity

<table>
<thead>
<tr>
<th>Near Unit</th>
<th>Distance Equivalent</th>
<th>Jager System</th>
<th>Foot System</th>
<th>N System Tested at 40 ft</th>
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<tbody>
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<td>10/20</td>
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<td>0.33</td>
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<td>0.50</td>
<td>0.33</td>
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<td>0.25</td>
<td>0.16</td>
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<tr>
<td>1.0</td>
<td>1.0</td>
<td>0.10</td>
<td>0.08</td>
<td>0.10</td>
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</tbody>
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Titmus and random-dot-E stereoacuity tests
VII. Pupillary exam

- Normal round, 3-5 mm
- Anisocoria—unequal sized pupils, normal in up to 20%
- Semi-dark room, bright light,
- Direct and consensual reaction should be equal

Pupillary exam

Afferent pupil defect: optic nerve
Direct light: pupil dilates
Consensual and near response: normal

Pupillary Exam

- Efferent defect: Either in Parasym or Sympathetic system
- CN III defect: no direct response, pupil dilated, no near response, no consensual
- Adie’s Tonic pupil: slow direct, near and consensual response, pupil dilated (decreased peripheral reflexes)
- Argyll-Robertson: miotic pupil, no direct or consensual response, normal near response (light-near dissociation)—midbrain lesion seen in sarcoid, multiple sclerosis

Pupillary Exam

- Sympathetic system:
- Horner’s syndrome: pupil constricted, normal reactions to light, near (ptosis, miosis, anhydrosis)

Pupillary exam

- Physiologic anisocoria
- Unequal size, normal reaction to light, near, consensual
- Amaurotic/blind eye: dilated pupil, no reaction to light, near, consensual

Titmus and random-dot-E stereoacuity tests
Pupillary light reflex

Evaluating the pupillary light response

Evaluating pupil size

Evaluating pupil size

Diagnosing relative afferent pupillary defect in the presence of an efferent pupillary defect

Extraocular muscle exam

- EOM actions (LR6 SO4)3
- Primary position of gaze
- Corneal light reflex- nasal to center of cornea
- Cover/Uncover test to test for phoria or tropia
- Alternate cover test- can measure amount of deviation
- Red lens test/Maddox rod test
- Six cardinal positions of gaze- note limitations
Cover-uncover test

Alternate-cover test

Corneal light reflex tests for ocular misalignment

The Worth-4-Dot test

Pseudostrabismus

Use of glasses to correct accommodative esotropia
Use of glasses to correct accommodative esotropia

Use of bifocal glasses to correct accommodative esotropia

Use of bifocal glasses to correct accommodative esotropia

Child with esotropia

VIII. Visual field exam

- Normal visual field: Superior 50, Nasal 60, Inferior 70, Temporal 90
- Test each quadrant - count fingers
- Simultaneous temporal and nasal fields - checks for extinction phenomenon (count fingers or red bottle tops)
- Amsler grid - central 10 degrees - monocular

Traquair’s island of vision
Traquair’s island of vision

Confrontation visual field testing

Amsler grid

Tangent screen

Goldmann manual kinetic perimetry

Automated static perimetry
IX. Biomicroscopy (Slit lamp)

- General inspection
- Cornea
- Anterior chamber
- Conjunctiva
- Lids/lashes
- Lens
Types of biomicroscopic illumination

X. Fundus exam
- Direct ophthalmoscopy
- Start with plano (0) power at 10 inches
- Note red reflex then add + power to focus on front of eye then add – power to focus from front to back of eye as you get closer to eye with scope
- Optic nerve head- note size of disc and central depression (cup) as a ratio called cup to disc ratio (CDR)- normal ratio is .3 or less and bilaterally symmetric
- Fovea and light reflex is lateral (temporal) to disc
- Note retinal artery and vein size as A/V ratio (normally 2/3 or greater)

Fundus exam
- Dilated exam
- Tropicamide (Mydriacyl) 1%
- Neosynephrine 2.5%

Types of biomicroscopic illumination

Papilledema
XI. The Red Eye
- Differential Dx
- Acute conjunctivitis
- Acute iritis
- Acute glaucoma
- Corneal trauma/abrasion

Evaluation of Red Eye
- Is vision affected?
- Check visual acuity!
- Foreign body sensation?
- Photophobia?
- Trauma?
- Contact lens wearer?
- Corneal fluorescein staining?
- Discharge?-purulence- bacterial

Red Eye Evaluation
General observation-penlight exam
Topical anesthetic (Tetracaine, Opthaine)?
Keratitis-corneal abrasion/contact lens overwear, photophobia
Iritis- no fb sensation, photophobic
Angle closure glaucoma- general distress, HA, malaise, nausea, vomiting, dull ache, decreased acuity, mid-dilated pupil, poor direct response

Red Eye Evaluation
- Pupil reaction- small if iritis, keratitis, abrasion
- Pattern of redness- "ciliary flush"- injection at limbus and indicates iritis, angle closure, or keratitis
- Corneal opacity/fb? White area= infectious keratitis
- Anterior chamber- hypopyon or hyphema?

Red Eyes Managed by Primary Care
- Conjunctivitis (bacterial, viral, allergic)
- Corneal abrasion
- Corneal foreign body
- Contact lens overwear
- Subconjunctival hemorrhage
- Blepharitis
- Stye
- Chalazion

Red Eyes- Referral Needed
- Angle closure glaucoma
- Hyphema
- Hypopyon
- Iritis
- Keratitis/corneal ulcer
Acute conjunctivitis/bacterial conjunctivitis
- Common
- Moderate to copious discharge/matting of lashes
- No effect on vision
- No pain
- Clear cornea
- Staph A., H.influenza, Strep pneu, Pseudomonas a.

Bacterial conjunctivitis
- Empirical therapy
- Broad spectrum- Polytrim, Ocufluox, Quixin, Sulfacetamide
- Erythromycin ophthalmic oint at night
- If cornea intact- Tobradex, Maxitrol, Pred-G, Vasocidin
- Use qid to q1h depending on severity
- Advise patient very contagious/hygiene

Viral Conjunctivitis
- Serous discharge, pre-auric nodes, injection, lid edema, fever, sore throat (PCF), corneal infiltrates, bilateral (EKC), subconj. hemorrhage
- Adenoviruses
- Highly contagious
- Usually self-limiting

Viral Conjunctivitis
- No work or school until no discharge
- Hygiene
- Topical steroids/combination med if cornea intact- Pred Forte/Tobradex bid-qid
- Tell patients- sx get worse for 7-10 days before getting better, resolve in 3-6 weeks

Chlamydial Conjunctivitis
- Consider if chronic red eye no better with other therapy
- Corneal pannus, corneal infiltrates, follicles, pre-auric node, mucus or stringy discharge
- Sexually active teens, young adults, neonatal
- Tx- Oral TCN for 3 weeks, Erythromycin for 3 weeks, Doxycycline for 1 week, or Azithromycin 1 gram- single dose
- Topical tx- Erythromycin, sulfacetamide tid x 3 weeks

Allergic conjunctivitis
- Hx of seasonal allergies/itching, photophobia, burning and conj injection
- Thin, watery discharge if seasonal
- Ropy, thick discharge with large papillae if vernal conjunctivitis
- Pre-treatment with Crolom, Alomide, Alocril, Alamast, Oplevar, Patanol x 4 weeks with recurrent seasonal allergies
- Tx- mild cases, cold compresses, artificial tears, Lacrilube, OTC topical decongestants
- Avoid rubbing eyes!
- Moderate to severe- Patanol or Livosin, topical NSAID (Acular, Voltaren)
- Topical steroids (Alrex, Vasocidin, Vexol, Flarex) if very symptomatic
- Topical Cyclosporine 2% gtt one if steroids ineffective
- Oral antihistamines
Giant Papillary Conjunctivitis (GPC)
- Associated with soft contact lens wear
- Fb sensation, itching, excess mucus and large (1 mm) papillae on upper lid conj
- Weeks to years after starting CL wear (mean= 18 months)
- Tx= stop CL wear, new lenses, preservative free solutions
- Artificial tears, Topical antihistamines (Patanol), topical steroids in severe cases

XII. Corneal/Conjunctival Foreign Body
- Check for corneal perforation/anterior chamber
- Fluorescein- look for aqueous leakage thru wound (Seidel’s sign)
- Topical anesthetic (ophthaine, tetracine)
- Evert upper eyelid
- Remove with swab, spud, needle, or burr under slit lamp
- If fb is in visual axis, advise regarding possible scarring and loss of acuity

XIII. Corneal Abrasion
- Visual acuity, Size, shape, location, depth
- Anterior chamber reaction (may have secondary iritis)
- Topical anesthetic- limit instillation
- Woods Lamp or Slt Lamp with fluorescein 5%); topical antibiotics, analgesia. Severe pain- topical NSAIDs (Acular, Voltaren)
- Patching may help pain if abrasion over 50% of cornea- not if contact lens wearers because of risk of infection
- If CL wearer-Ciloxan, Ocuflox, Tobrex

XIV. Chalazion
- Painless nodules in lids
- Granulomatous inflmm of Meibomian glands
- Topicals won’t help
- Hot compresses/massage qid
- Kenalog 10/ml- use up to 0.3ml from palpebral side and 30 gauge needle
- Depigmentation may occur- don’t use if dark skin
- Biopsy if recurrent to r/o sebaceous gland Ca

XV. Hordeolum (stye)
- Painful, swollen lid with pustule (this differentiates from chalzion)
- Staph infection of glands
- Topicals won’t help
- Oral antibiotics (Diclox, E-mycin, TCN, Amoxil x 10 days)
- I&D if external
- May result in chalazion if chronic

XVI. Preseptal cellulitis
- Painful, swollen lid, normal vision and motility; no proptosis
- Not systemically ill/may follow sinusitis
- Staph, Gr. A Strep, Strep pyogenes
- Limit spread to posterior septum with immediate oral antibiotics (Amoxicillin, Augmentin, E-mycin, IV Nafcillin,Oxacillin if severe)
XVII. Orbital cellulitis
- Pain, red, swelling, proptosis, vision loss, loss of motility, systemically ill, fever
- Spread from teeth, sinus, lid penetration
- Staph, Strep, H. flu
- Potential- intracranial infection, septicemia, cavernous sinus thrombosis
- Immediate hospital/ IV antibiotics (Cefuroxime, Cefoxitin, Ceftriaxone, Ticar/Clavulanate)

XVIII. Blepharitis
- Inflamm of lid margins and lashes
- Red, collarettes (fibrin around lashes), madarosis (loss of lashes), trichiasis (inturned lash), plugged glands, conjunctivitis
- Lid hygiene- tearless shampoo, commercial scrubs (Ocu-clear, Lid Scrub, Lid Wipes)
- Moderate, severe, chronic- topical or oral meds: Sulfacetamide, Tobramycin, E-mycin, Polysporin bid-qid
- Excessive inflam and pain- use combo meds: Tobradex, Maxitrol, Blephamide, Vasocidin

XIX. Dacryocystitis
- Nasal aspect, lower lid
- Mucopurulent discharge
- Fever, severe red swelling
- Anaerobes: Pepto-streptococcus, Propionibacterium, Fusobacterium most freq pathogens
- If afebrile- oral antibiotics (Augmentin, Ceclor), topical antibiotics, warm compresses
- If febrile- hospitalized with IV Ancef

XX. Episcleritis
- Sectoral injection, cornea clear, mild pain
- Young adults, self-limiting (2-3 days), usually idiopathic, may be assoed with RA, SLE, IBD, Gout, Sarcoidosis
- Topical mild steroids (FML, Pred-mild) q 4 h; cold compresses, artificial tears

XXI. Scleritis
- Severe, boring pain, photophobia, decreased vision, tearing
- Scleral vessels dilated, deep red in sector or diffuse pattern
- Tx- cycloplegia, topical steroid, oral NSAID, oral prednisone
- Consider underlying systemic disorder: RA, SLE, Gout, Syphilis, Zoster, Ankylosing spondylitis, Wegener’s granulomatosis
- Tests: CBC, ESR, RF, ANA, HLA-B27, FTA-ABS, CXR, S-I joint films

XXII. Pinguecula/itis
- Yellow, lipid-like deposits at limbus of exposed conjunctiva
- Degeneration of collagen in conjunctiva results in dryness, irritation
- Older population, environmental exposures, Solar/UV light
- Ocular lubricating drops: Tears Naturale II, Lacrilube, Refresh PM
- Topical steroids: Pred Mild, Vexol, Pred Forte, Inflamase Forte
**XXIII. Pterygium**
- Raised, red, triangular wedge, fibrovascular growth on nasal limbus
- UV light exposure, warm dry climates or dust/smoke
- Topical decongestants (Naphcon-A); steroids (FML, Vexol, Pred-mild)
- Surgery if in visual axis/ cosmesis

**XXIV. Ocular Trauma**
- Have A,B,Cs been addressed?
- What was vision before injury and after injury?
- Is there past hx of amblyopia
- Did it occur at work?
- Eye protection and what type?
- Chemical exposure/eye irrigated?
- Paresthesias around the eye?
- Last oral intake?

**Ocular Trauma**
- Visual acuity is most important element
- Examine bony structure of orbit for displacement
- Blowout fx accompanies blunt trauma
- Enophthalmos, restricted motility, lid anesthesia
- Tx broad spectrum antibiotics
- Thorough check for globe perf
- Hyphema- tx strong cycloplegia and bed rest x3-5 days. Check IOP.

**Blow Out Fracture**
- Signs: edema, ecchymosis of lid
- Restriction of motility especially vertical
- Orbital crepitus (subcut emphysema)
- Hypoesthesia of ipsilateral cheek, entrap of infraorb nerve, Risk of medial wall fx is orbital cellulitis
- CT of orbits- axial and coronal views
- If entrapment, with diplopia, surgery in 10-14 days to allow for resolution of hemm and edema
- Medial wall fx- start Keflex, E-mycin qid x14 d. Medial wall fx resolves spontaneously in 3-

**Ocular trauma-chemical burn**
- Alkali more serious than acid
- Acids create initial burn then cease, alkali penetrate cornea to destroy stroma, and endothelium
- Copious flush with saline
- Test with litmus paper; if pH 6-8, dc lavage
- Debride necrotic tissue with slit lamp
- Swabs in fornices
- Cycloplegic and broad spectrum antibiotic
- Pressure patch if large area (50%)
- Add topical 1%prednisolone acetate q 2-4.
- Monitor IOP
Commotio retinae

Hordeolum

Adenovirus infection: clinical features, diagnosis, and treatment

Subconjunctival hemorrhage

Giant papillary conjunctivitis

Scleritis
Episcleritis in rheumatoid arthritis

Seborrheic blepharitis is probably the most common cause of anterior lid margin involvement

Correlation of recurrence with pterygium morphology

Asymmetry of the optic cups

Asymmetry of the optic cups

Traumatic hyphema
A 14-year-old girl who presented with a red, sensitive right lower eyelid

Streptococcal bacterial cellulitis secondary to orbital trauma

Cortical cataract

Posterior subcapsular cataract

Less severe nonproliferative diabetic retinopathy

Preseptal cellulitis
Nasolacrimal sac massage

Dacryocystitis

Conjunctivitis

Dacryocystitis in a boy aged 16 years

Hemorrhagic conjunctivitis

Dacryocystitis in a neonate aged 2 weeks
Acute conjunctival chemosis

An 8-year-old girl with "allergic shiners"

Hypopyon in juvenile rheumatoid arthritis

Band keratopathy in juvenile rheumatoid arthritis

Peripheral thinning of the cornea

Punctate epithelial erosions, punctate epithelial keratitis, and punctate subepithelial infiltrates
Herpes infection of the eye

Optic nerve drusen

Acute anterior uveitis

Anterior segment complications of closed-globe injury

Thelazia gulosa
XXVI. Skills Stations

- Slit Lamp Evaluation of the Eye
- Eyelid eversion using slit lamp
- Corneal foreign body removal with slit lamp
- Fluorescein staining of the eye/Woods Lamp