

1 ***Diagnosis and Management of the Pediatric Patient***

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3 ***Pediatric Examination Techniques***

4 **Infant/Preschool Exam Summary**

- Case History
- Vision/Visual Acuity
- Refraction
- Alignment / Motility
- Ocular Health
- Parent Education

5 **What equipment do you need?**

- Transilluminator
- Age appropriate toys
- Direct Ophthalmoscope
- Retinoscope
- Loose lenses / Lens Bars
- Loose Prisms
- BIO
- 20 D lens

6 **Suggested Equipment**

- Hand held keratometer
- Monocular Indirect Ophthalmoscope
- Hand held Slit Lamp
- Tonopen
- Infant Visual Acuity Tests
- Infant Stereo tests

7 **Evaluation of the Infant/Toddler**

8 **Examination Step by Step**

- I - Case History
- II - Vision / Visual Acuity Assessment
- III - Ocular Motility Assessment
- IV - Refractive Error Assessment
- V - Posture/Strabismus Evaluation

- VI - Vergence / Accommodative / Stereopsis / Color Vision
- VII - Ocular Health Evaluation
- VIII - Rule out Amblyogenic factors

9 **Case History**

- **Perinatal History**
 - Full term?
 - Complications during pregnancy / delivery?
 - Birth weight / prematurity
 - 5 lb 8 oz = normal
 - Premature = < 37 weeks
 - Oxygen exposure

10 **Case History**

- **Medical History**
 - Medications ?
 - Allergic to medications ?
 - Allergies?
 - Review of Systems

11 **Case History**

- **Ocular / Family Ocular History**
 - Common Chief Complaints
 - History of prematurity = ↑ risk
 - Delayed motor development
 - Frequently rubs eyes / Blinks excessively
 - Eye turn
 - Cannot maintain eye contact or fixation
 - Poor eye tracking skills
 - Failed pediatrician / preschool screening

12 **Case History**

- Previous Ocular Diagnosis & Treatments
 - Occlusion
 - EOM surgery
 - Spectacle / CL Correction
- Family History
 - High refractive error
 - Strabismus / Amblyopia
 - Ocular pathology

13 **Developmental Milestones**

- Question to elicit history of developmental delay....
- *Is the patient undergoing any of the following therapies?*
 - Physical
 - Occupational
 - Speech
 - Developmental

- 14 **Evaluation of the Infant/Preschooler**
Visual Acuity/Vision Assessment
- 15 **ADMINISTRATION OF CYCLOPLEGIC IN CLINIC**
- **Cycloplegic Spray**
 - 0.5% Tropicamide
 - 0.5% Cyclogel
 - 2.5% Phenylephrine
 - O'Brien Pharmacy
 - 1-800-627-4360
- 16 **Evaluation of the Infant/Toddler**
Posture Assessment
- 17 ***Prescribing for Infants and Toddlers***
- 18 **Prescribing Review**
- Isometropia Risks
 - Anisometropia Risks
 - Strabismus Risks
 - Visual Function / Visual Acuity
 - Soft Binocular Vision Disorders
 - Prescribing Guidelines
 - *Each patient is an individual*
 - *Each practitioner has individual preferences!!*
- 19 **Statistics**
- 25% of school age children have vision problems
 - 11.5% of teenagers have undetected or untreated vision problems
 - Early detection of child's vision problem ↓ negative effect on child development
- 20 **Refractive Error Norms**
Hyperopia
- *Highest rate of emmetropization - 1st 12-17 months*
 - *Average refractive error in infants = +2 D*
 - *> 1.50 diopters hyperopia at 5 years old - often remain hyperopic*
 - Why do eyes become less hyperopic with time?

- Increase in axial length of eye with age

21 **Refractive Error Norms**

Myopia

- ***25% of infants are myopic***

- Myopic Newborns (Scharf)
 - @ 7 years 54% still myopic
 - @ 7 years 46% emmetropic
 - @ 7 years no hyperopia

22 **Refractive Error Norms**

Astigmatism

- ***Against the rule*** astigmatism more prevalent switches to ***with-the-rule*** with development
- @ 3.5 years old astigmatism is at adult levels

23 **POTENTIALLY AMBLYOGENIC REFRACTIVE ERRORS**

<u>ISOMETROPIA</u>	<u>DIOPTERS</u>
• Astigmatism	> 2.50 D
• Hyperopia	> +5.00 D
• Myopia	> -8.00 D

<u>ANISOMETROPIA</u>	
• Astigmatism	> 1.50 D
• Hyperopia	> +1.50 D
• Myopia	> -3.00 D

24 ***Case Example***

25 2 y.o. Hispanic Female

- FT birth / (-) developmental delay
 - c/o getting close to TV and books
- Visit #1
 - DVA :UTT (poor cooperation noted)
 - F&F
 - DCT / NCT : orthophoria
 - EOM : FROM OD, OS
 - Stereopsis: UTT

26 2 yo HF

- Cycloplegic Retinoscopy
 - - 5.00 -2.50 x 180 OD, OS

- Assessment / Plan
 - High Myopia/Astigmatism
 - Rx given = -5.00 -1.50 x 180
 - RTC 1 month after Rx wear

27 2 yo HF

- Visit #2
 - Tremendous compliance with Rx, Mom notes behavioral changes
 - No longer gets close to things
 - More attentive
 - More active
 - More emotionally connected
- DVA : 20/30 OD, OS (Lea Symbols)
- Stereopsis: (+) Fly

28 **Bilateral Spherical Refractive Myopia**

- Prescribing Guidelines
 - ≥ -5 D - Rx at any age
 - -3-5 D - Rx at 1-3 years of age
 - -1-3 D - Rx if > 3 years of age
- Amblyopia Risks
 - Isometric Amblyopia risk @ > -8 D

(Ciner)

29 **Case Example**

30

22 month old male

3 Visits/ First at 14 months

- Spina bifida w/ hydrocephalus
- Significant Developmental Delay
 - (+) OT/PT/Speech/Developmental Therapy
- Asthma
- No visual complaints
- VA : F&F OD, OS
- NCT : Exophoria

31 22 month old male

- Cycloplegic Retinoscopy :
 - 14 months old
 - +7.00 - 3.50 x 180 OU
 - 18 months old
 - +4.00 - 2.00 x 180 OU
 - 22 months old
 - +4.00 -2.00 x 180 OU

32 22 month old male

- Assessment/Plan
 - Hyperopic Astigmatism
 - Above age appropriate
 - Significant developmental delays
 - Rx given = +3.00 -2.00 x 180 OU
 - Follow-up 3-4 months

33 Emmetropization

- A process presumed to be operative in producing a greater frequency of occurrence of emmetropia than would be expected in terms of chance distribution, as may be explained by postulating that a mechanism coordinates the formation and the development of the various components of the human eye which contribute to the total refractive power

34 Emmetropization

- Passive process = nature and genetics
 - 60% chance of myopia if 2 parents myopic (*Ciuffrieda*)
- Active process = mediated by blur and visual system compensates for blur

35 Bilateral Spherical Refractive Hyperopia

- Prescribing Guidelines
 - < +2 D - do not Rx until 5 years of age
 - Excluding
 - esophoria
 - esotropia
 - Amblyopia
 - ≥ +2 D - consider Rx with attention to :
 - excessive accommodative effort
 - risk of amblyopia or strabismus
 - Monitor at risk patients every 3 months
 - Monitor lower amounts at 6 months of age, 1 y.o., 2-3 y.o. years, and 5 years
- Amblyopia Risks
 - Isometropic Amblyopia risk @ > +5 D (*Ciner*)

36 **Case Example**

37

Bilateral Spherical Refractive Hyperopia

2 year old female

38

Bilateral Spherical Refractive Hyperopia

2 year old female

39

Bilateral Spherical Refractive Hyperopia

2 year old female

• **Cycloplegic Retinoscopy**

- OD +7.50D

- OS +7.50D

40

Bilateral Spherical Refractive Hyperopia

2 year old female

• ***Dry Ret : +7.00***

• ***Cyclo Ret : + 7.50***

• ***20/25 VA : +5.00***

• **Rx Given**

- OD + 4.50 D

- OS + 4.50 D

41

Case Example

42

Hyperopic Anisometropia

• 3 year old male

• Hearing impaired, cochlear implant after diagnosis

• **Visual Acuity**

- OD UTT

- OS 20/20

• **Cover Test**

- Orthophoria

• **Cycloplegic Retinoscopy**

- +7.50 UTT

- +1.50 20/20

- Rx given?

43 **Hyperopic Anisometropia**

- Last visit
 - OD +6.00 sph 20/25
 - OS plano 20/20

44 **Case Example**

45 **Hyperopia with Esotropia/ 3 year old female**

- **Case History**
 - Mom c/o eye crossing when child concentrates on something x 2-3 months
 - No significant family ocular history
- **VA** (sc) 20/25 OD, OS
- **Cover Test** (sc) 10 Δ E' (initially)
- **Stereopsis** (+) Lang forms

46 **Hyperopia with Esotropia/ 3 year old female**

- **Repeat Cover Test** (later in exam)
 - AE(T) = 20Δ
- Dry Retinoscopy = +2.50 D sphere OU 20/20 OD, OS
- Trial Frame = +3.50 D sphere OU 20/25 OD, OS
- **Repeat Cover Test with +3.50 OU**
 - Orthophoric
- **Cycloplegic Retinoscopy**
 - +5.00 D sphere OU

47 **Hyperopia with Esotropia
3 year old female**

- **Assessment**
 - Accommodative Esotropia
- **Plan**
 - Rx given +4.00 OU
 - RTC 1 month after Rx wear for re-evaluation

48 **Case Example**

49 **Prescribing for Exotropia : 3 year old male**

- **Case History**
 - intermittent alternating exotropia x 1 year
 - > in AM, when tired, in sunlight
- **Visual Acuity** (sc) Allen Pictures

- 20/30 OD, OS distance & near

- Cover Test (sc)
 - Distance 45Δ AX(T) (95%)
 - Near 35Δ AX(T) (75%)
- Stereopsis (sc)
 - (+) Forms Lang

50 Prescribing for Exotropia : 3 year old male

- Auto Keratometry
 - 40.75/43.12 × 176
 - 41.00/ 43.87 × 019
- Retinoscopy
 - +1.50 - 2.00 × 180
 - +1.50 -3.50 × 180
 - CT : 40 Δ AX(T)

51 Prescribing for Exotropia : 3 year old male

- Trial Frame
 - pl -2.00 × 180 20/20
 - pl -3.50 × 180 20/20
 - CT : 25 Δ X'
 - CT: 40 Δ AX(T) (60%)

52 Ocular Medications & Children

53 Ocular Medications & Children

- The rules:
 - birth → 2 years old = 1/2 dose
 - 2-3 years old = 2/3 dose
 - > 3 years old = adult dose
- *If only 50 % is absorbed may be 10x maximum dosage*

54 Ocular Medications & Children

- Pediatric systems differ in :
 - drug excretion
 - kidney is the main site of drug excretion
 - Diminished 2° renal immaturity
 - biotransformation
 - liver is organ for drug metabolism
 - Impaired 2° enzyme immaturity

55 Ocular Medications & Children

• Differences in Infant / Newborn Positioning

- Supine position
- Greater tear flow
 - ↑ Rapid dilution
 - ↑ Outflow to cheek
- Maintain a > systemic risk than adult

Punctal Occlusion for 3-4 minutes ↓ systemic absorption by 40%

56 Ocular Medications & Children

• *Systemic absorption occurs through.....*

- Mucous membrane of Nasolacrimal Duct
 - 80% of each gtt passing through NLD system is available for rapid systemic absorption by the nasal mucosa
- Conjunctiva
- Oropharynx
- Digestive system (if swallowed)
 - Modified by variation in Gastric pH, delayed gastric emptying & intestinal mobility
- Skin (2^o overflow from conjunctival sac)
 - Greatest in infants
 - Blood volume of neonate 1/20 adult
 - Therefore absorbed meds are more concentrated at this age

57 Ocular Medications & Children

• *Ocular Meds with strongest potential for pediatric SE :*

- 10 % Phenylephrine
- 2 % Epinephrine
- 1 % Atropine
- 2 % Cyclopentolate
- 1 % Prednisone

58 Ocular Medications & Children

- *Distribution to Site of Action in Pediatric Patients determined by :*
 - Size of body fluid compartment
 - Muscle mass
 - Fat storage
 - Tissue blood flow
 - Protein binding capabilities
- *Package inserts warn*
 - *"safety and efficacy has not been established in children"*
 - *FDA recognizes that accepted medical practice often includes prescribing medications for use in patient populations that are not included in approved labeling (PDR ophthalmology)*

59 Ocular Medications Age Approvals

60 Ocular Medications & Children
Anti-biotic Ointments

Drug	Age Approval
Erythromycin	≥ 2 months
Tobrex	≥ 2 months
Ciloxan	≥ 2 years
Polysporin	≥ 2 years

61 Ocular Medications & Children
Anti-biotic Drops

Drug	Age Approval
Polytrim	≥ 2 months
Ciloxan	≥ 1 yr
Zymar	≥ 1 yr
Vigamox	≥ 1 yr
Gentamycin	unknown
Sulfacetamide	unknown


62 Ocular Medications & Children
Topical Allergy Drops

Drug	Age Approval
Patanol/Pataday	≥ 3 years old
Elestat	≥ 3 years old
Zaditor	≥ 3 years old

63 Ocular Medications & Children
Topical Steroids/Anti Viral Agent

Drug	Age Approval
• Steroid	
- FML	≥ 2 yrs
• Steroid-Antibiotic Combination	
- Tobradex	≥ 2 yrs
- Blephamide	≥ 6 yrs
• Anti-viral	
- Viroptic	≥ 6 yrs

64 Ocular Pathology

- 65  **Leukokoria**
- Must determine anatomic location of lesion
 - Differential Diagnosis:
 - Congenital Cataract
 - Retinoblastoma
 - Retinopathy of Prematurity

66  **Leukokoria Differential Diagnosis**

- **Congenital Cataracts**
 - 1/10,000, 400-500 infants per year
 - Risk of Image Degradation Amblyopia

67  **Congenital Cataract**

- **Treatment**
 - Cataract Extraction
 - IOL implant
 - Contact Lens Fit
 - Amblyopia Therapy
 - Prior to end of critical period
- **Contact Lens Fit**
 - May combine with spectacles
 - ↓ magnification
 - 20-30 % with specs
 - 8-12 % with contact lenses
 - Improves development, cosmesis

68  **Leukokoria Differential Diagnosis**

- Retinoblastoma Characteristics
 - 1/15,000 births
 - Fatal if not treated /early detection before spread to the other eye ↑ survival rate
 - In the developed world >90% of patients with intraocular retinoblastoma survive
- Presenting signs
 - Leukocoria (#1)
 - Strabismus (#2)
 - Red/painful eye with glaucoma
 - Poor vision
- Treatment
 - Immediate referral and likely enucleation

69  **Retinoblastoma**

70  **Leukokoria Differential Diagnosis**

Retinopathy of Prematurity

- A premature infant is an infant born before **37 weeks** gestation
- Prematurity used to be defined as any infant weighing less than **5.5 lbs**
 - **ROP**
 - 40% of infants with birth weight 1-1.5 kg
 - 50%-80% of neonates under 1 kg

71 Retinopathy of Prematurity

- Retinal vascular disease secondary to premature birth, low birth weight, and use of supplemental oxygen
- Clinical severity can range from mild with no visual defects to aggressive with neovascularization, retinal detachment, and blindness.

72 Retinopathy of Prematurity

- Pathophysiology
 - Retinal vasculature begins at **16 weeks** gestation
 - Proliferation of capillaries will form the mature retinal vessels
 - The nasal portion of the retina becomes completely vascularized to the ora serrata by **32 weeks** gestation
 - The temporal portion is completed at **40-42 weeks** gestation

73 Common Presentations of Pediatric Red Eyes

74 Nasolacrimal Duct Obstruction

- *Clinical Characteristics*
 - 5-6% of newborns
 - Constant tearing
 - Redness/irritation of lids
 - ****With secondary conjunctivitis**
 - Discharge
 - Injection
 - swelling over innermost aspect of lower lid
 - pain
 - Fever

75 Examination of NLDO Patients

- Sx: recurrent tearing, possible discharge
- *Fluorecein Disappearance Test*
 - Instill NaFl into conjunctival sac
 - Inspect at 2-4 minutes
 - Grade NaFl left behind 0-3
 - 0 = no fluorecein
 - 3 = fluorecein left behind
 - 0-1 = Normal
 - If the dye fails to disappear in several minutes an obstruction in the lacrimal drainage system can be presumed

76 Nasolacrimal Duct Obstruction TREATMENT OPTIONS

- 1) Warm compress / Hydrostatic Massage
- 2) Topical Antibiotic Drops
- 3) Probing

77 Instructions

- Warm Compress
 - 5-10 minutes of continuous warmth
 - Options

- Lacrimal Sac Massage
 - Use index finger wrapped in clean, thin, cloth
 - Begin between infants eyebrow
 - Drag finger down towards affected side, closing lid simultaneously
 - Continue movement, pressing firmly into the canthus
 - Continue onto cheek
 - 10 strokes / tid

78 PARENTAL EDUCATION REGARDING THE COURSE OF NASOLACRIMAL DUCT OBSTRUCTION

1983 T. Otis Paul

55 infants diagnosed with NLDO prior to 3 month old

Percentage of Spontaneous Resolution by 1 year of age

- 3 months - 15%
- 6 months - 46%
- 12 months - 93%

79 Differential Diagnosis

The Pediatric Red Eye

- Bacterial conjunctivitis
- Viral conjunctivitis
- Allergic conjunctivitis
- Preseptal Cellulitis
- Uveitis
- Foreign Body / Abrasion

80 Bacterial Conjunctivitis Tx

- Less likely to use:
 - Gentamycin - Corneal Toxicity
 - Sulfacetamide - ↑ allergies / SJS
 - Chloramphenicol - aplastic anemia
- *Common Drop* :
 - Polytrim - wide spectrum, ↓ toxicity
- With ↓ response to treatment with Polytrim:
 - Fluoroquinolones
- Topical Antibiotic Therapy for 7- 10 days
 - Polytrim (trimethoprim/polymixin) qid
 - Erythromycin / Bacitracin ointment qid
 - Vigamox tid

81 Viral Conjunctivitis Tx

• *Treatment Options*

- Supportive
 - Artificial Tears 4x - 8x / day
 - Cool Compress 3x -4x / day
 - Vasoconstrictor/antihistamine qid prn
- Instruction of proper hygiene / avoidance of family members
- Discuss daycare / School attendance issues

82 Allergy Patients

- 15% of population affected
- Complain of feel tired / sick
- Affects concentration
- Cannot play sports / participate in outdoor activities

- Attack points
 - Eyes
 - 90% have ocular symptoms
 - Nose
 - Sinuses
 - Lungs
 - Skin

83 Allergic Conjunctivitis

- **Clinical Presentation**
- Signs
 - diffuse ocular injection
 - watery and or mucous discharge
 - conjunctival chemosis
 - red, edematous eyelids
 - often bilateral
 - no PAN
- Symptoms
 - Itching
 - 80% of cases
 - **Exacerbated** (not relieved) by rubbing
 - Burning
 - Foreign body sensation

84 Summary of Pediatric Red Eyes

- **Conjunctivitis**
 - Bacterial
 - Viral
 - Allergic
 - Herpes Simplex
- **More severe**
 - Preseptal cellulitis
 - Orbital cellulitis

85 PRESEPTAL CELLULITIS

- **Definition** - inflammation of the lid structures anterior to the orbital septum
- **Clinical Characteristics**
 - eyelid edema
 - erythema
 - warmth of eyelid
 - conjunctival chemosis / ocular discharge
 - **NOT PRESENT**
 - proptosis
 - restriction of ocular motility
 - pain with eye movement

86 PRESEPTAL CELLULITIS

- **Possible Etiologies**
 - Chronic Blepharitis / conjunctivitis
 - Internal Hordeolum
 - Acute Dacryocystitis
 - Penetrating Injury
 - Bite Wounds
 - Respiratory Infection

- Sinusitis
- Dermatitis

87 **PRESEPTAL CELLULITIS**

- *Differential Diagnosis*

- Orbital Cellulitis ****
- Allergic Lid Edema
- Viral Conjunctivitis with Lid Edema

88 **PRESEPTAL CELLULITIS
TREATMENT OPTIONS**

Mild > 5 y.o.
ORAL ANTIBIOTICS

Moderate to Severe

IV ANTIBIOTICS

89 **PRESEPTAL CELLULITIS**

- *How to determine severity / treatment options:*

- Is patient toxic?
- Is patient/parent non-compliant with treatment?
- Child < 5 years old
- No improvement within 3-4 days of administering oral anti-biotic

90 **ORBITAL CELLULITIS**

- *Clinical Characteristics*

- unilateral orbital tenderness
- Pain on eye movement
- PARALYSIS of extraocular muscles
- Proptosis
- Papilloedema
- Blurred vision
- fever / systemic illness

91 **ORBITAL CELLULITIS**

- *Differential Diagnosis*
 - Preseptal Cellulitis
- Differentiation made by :
 - Fever

- Vision loss
- Motility limitation
- Proptosis

92 **ORBITAL CELLULITIS**
TREATMENT OPTIONS

CT Scan

IV ANTIBIOTICS

93 **Cellulitis Case**

- 5 yo AA female
 - Left eye swelling x 5 days
 - Given Augmentin (ER) - NI
 - Symptoms worsening
 - (+) injection, discharge and tenderness
 - (-) hx of trauma or allergies

94 **Cellulitis Case**

- Examination Findings
 - VA = 20/20 OD, OS
 - 4+ lid edema OS
 - area of tenderness left upper brow
 - (+) injection and discharge
 - (-) cell / flare in AC
 - (-) proptosis
 - (-) EOM restriction,
 - (-) Pain on eye movement

95 **Cellulitis Case**

- Assessment / Plan
 - Likely Preseptal cellulitis
 - Ordered CT orbit / sinus (if abcess seen = admit)
 - Rx Zymar tid
 - Continue with Augmentin
 - RTC 1 day

96 **Cellulitis Case**

- One week follow-up
 - Mom notes decreased edema and injection
 - Possible hordeolum in left UL
 - (+) UL edema
 - (+) conjunctival injection
 - (-) discharge
 - Continue with
 - Zymar tid
 - Augmentin (10 day cycle)
 - RTC 1 week

97 **Cellulitis Case**

• Two-week Follow-up

- Elicit history of styes and allergies as per Mom
- (+) papillae and mild conjunctival chemosis
- Minimal injection
- Minimal lid edema
- D/C anti-biotic medications
- Rx Pataday prn for ocular allergies
- Rx Lid scrubs and warm compresses bid to aid in decreasing development of chronic hordeola

98 **Summary**

99 **QUESTIONS?**

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