Management of Esotropia
For the Primary Care Eye Doc

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Course Objectives

• Examination tips
• Differential diagnosis strategy for ET
• Treatment overview – primary care perspective
  – What to do? In what sequence?
  – When to co-manage?
  – Best surgical candidates?

ET Management: What Do I Do?

Fundamental Principles of Treatment

• All ET’s are not the same
• Treatment is based on:
  – Type of ET
  – Diagnostic profile including sensory fusion status
Diagnostic Tips: A Primary Care Perspective

Ocular Alignment / Motility
- Observation
- Random dot stereopsis
- Cover testing
- Hirschberg/Krimsky
- EOM's

Head Tilt or Turn? Chin Tip?

Cover Testing - Near

Near Target & Instructions

Alternate Cover Testing - Near

Stress Clarity
Cover Testing - Distance

Hirschberg Test

Krimsky Test

Stereopsis Tests
Random Dot vs. Lateral Disparity

RDS: No monocular cues; typically must be bifoveal

Titmus Fly
Randot Stereotest

Random Dot Test (LEA)

RDS Stereotests

Versions: Extraocular Muscles

Monocular Visual Acuity

Versions
Cycloplegic Refraction Is Essential

Non-negotiable!
Retinoscopy with other eye occluded

Ocular Health Evaluation

Other Testing

• Comitancy
  – Cover test in different fields of gaze
  – Maddox rod in different fields of gaze
• Second-degree fusion
  – In-instrument & free space
  – With & without neutralizing prism (added lenses)
• Correspondence
• Monocular fixation if amblyopic

Based on History & Diagnostic Evaluation...........

What Kind of ET?

Classify the Esotropia

• Pseudo
• Infantile (Congenital)
• Accommodative
• Partially Accommodative
• Acute-Onset Comitant
• Sensory
• Abducens (VI CN) Paresis
• Duane’s Retraction Syndrome I
• Microtropia/Monofixation Syndrome

Pseudoesotropia

• 10-19% later diagnosed with esotropia
• Serial examinations & parent education recommended

### PseudoET: Differential Dx

- Rule out other forms of bonafide ET
- Eye alignment & random dot stereopsis testing
- Follow-up

### Infantile (Congenital) Esotropia

- Neurologically intact child with constant non-accommodative larger-angle ET
- Develops by 6 months of age
  - Typically not present at birth, but develops at 2-4 months of age*

*Nixon et al., Am J Ophthalmol 1985; 100:798-801

### Infantile ET

#### Consistent Characteristics

- Onset < 6 months
- Large (30-70Δ) relatively stable angle
- Normal CNS

#### Variable Characteristics

- OIO ≥ 72% (> 1 yr)
- DVD 50-75% (> 2-3 yrs)
- A- or V-pattern
- Latent or m-latent nystagmus
- Amblyopia 35-72%
- Apparently defective abduction
- Crossed fixation

### Overacting Inferior Obliques

### Dissociated Vertical Deviation (DVD)

Spontaneous turning of 1 or both eyes upward when fatigued, inattentive, or fusion disrupted by covering that eye

### Infantile ET

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- A- or V-pattern
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- Apparently defective abduction
- Crossed fixation

#### Diagnosis
- Onset < 6 months
- Large (30-70Δ) relatively stable angle
- Normal CNS
- Rule out accommodative & other forms of ET!
  - Prescribe max plus (lower limit?)

#### Prognosis
- Poor for normal BV
- Reasonable for cosmetic alignment & peripheral fusion

#### Management
- Suggest refer to Peds OD prior to surgical referral....
- Definite surgical candidate
  - Timing of surgery?

#### Surgery: Timing for Infantile ET
- In general, early surgery seems to give better chance of better stereopsis
  - Typically gross stereo

- CAVEATS:
  - Early surgery doesn’t guarantee good stereo
  - Multiple surgeries often required
  - Advocates of <12 mos don’t advocate <6 mos
  - Unstable / inaccurate measures in infants
Spontaneous Resolution of Early-Onset ET: CEOS

- Prospective observational study (n=170) to determine predictors of spontaneous resolution
- Enrolled at 4-20 weeks, ≥ 20Δ ET
- Outcome at 30 weeks (7-8 mos age)

Accommodative ET- Characteristics

- Ave onset = 2-3 yrs (4 mo - 7 yrs)
- Onset intermittent
- Gradual ↑ frequency & duration
- Moderate size (≈20-40 Δ); varies w/ physical state / accommodation
- Near ET ≥ Distance ET

Accommodative Esotropia

- Accommodative
  - Refractive (normal AC/A)
  - Non-refractive (high AC/A)
  - Combined
- Partially Accommodative

Accommodative ET - Characteristics

- Initially no sensory adaptations
- Sns/sx: int diplopia, asthenopia, closing eye w/ close work, none

Accommodation in Young Children

- Slope of accommodative demand-response and amount of lag mature by 6 months of age

Accommodative Esotropia

• Prognosis typically excellent if still.....
  – Intermittent
  – Short duration

Accommodative ET: Treatment

• Surgery contraindicated
• Consider full cyclo Rx (esp. if constant)
• Consider add at near (if high AC/A)

<table>
<thead>
<tr>
<th>Angle</th>
<th>AC/A Ratio</th>
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<tbody>
<tr>
<td>Distance = Near = IPD (cm); normal</td>
<td></td>
</tr>
<tr>
<td>More eso at near &gt; IPD (cm); high</td>
<td></td>
</tr>
<tr>
<td>More exo at near &lt; IPD (cm); low</td>
<td></td>
</tr>
</tbody>
</table>

Kurt: 3 years

Georgia - 2 years old

• 2nd opinion

Suspected Accommodative ET

• Follow up is crucial
  – Cover testing & RDS stereopsis testing

Partially Accommodative ET

• Accommodative component, but residual ET following full correction of ametropia
• Verify refraction carefully
• Follow up crucial; likely to have/develop amblyopia, suppression, AC
Partially Accomm ET: Prognosis

- Depends on goal: cosmetic vs. normal BV
- Refer to Peds OD if residual ET
  - Consider other tx: add, prism, VT, surgery

Acute-Onset Comitant ET

- Onset often sudden; can be variable/intermittent over several weeks
- Typically, larger angle
- Not related to refractive error
- Normal AC/A
- Diplopia likely, but most not report, but may close / wink an eye

Acute-Onset Comitant ET: Etiology

- Following aggressive occlusion
- Post physical, emotional shock, or stress
- Idiopathic
- Neurological causes

Acute-Onset Comitant ET: Diagnosis

- Rule-out underlying neurological cause
- Neurological signs / symptoms warranting definite referral
  - Headache
  - ONH edema
  - Clumsiness, ataxia, gait imbalance
  - Nystagmus, APD
  - Nausea or vomiting
  - Enlarged head size

Neurological Causes of Acute-Onset Comitant ET

- Neurological etiologies – non localizing lesions:
  - Cerebellar astrocytoma; cerebellar medulloblastoma; pontine glioma
  - Pseudotumor; posterior fossa pilocytic astrocytoma; nasopharyngeal angiofibroma
- Most have neurological signs & symptoms
- Rare but can have no other signs except the acute-onset ET


Prognosis & Management
Acute-Onset Comitant ET

• Prognosis: very good for normal BV (if no CNS pathology)
• If neuro consult negative and Rx’ed full plus and ET still present → consult with Peds OD
  – Prism, VT, surgery

Sensory Esotropia

• 2° to severe VA reduction caused by eye abnormality
  – Congenital / traumatic cataracts
  – Corneal opacities
  – ONH or retinal lesions
  – Macular disease
  – Uncorrected anisometropia

Sensory ET: Characteristics

• VA = 20/60 - LP
• Amblyopia may be superimposed
• Magnitude of ET varies

• Sensory ET vs. XT? Based on age of onset?

Diagnosis of Sensory ET

• Rule out other forms of ET
• Eye health evaluation is key
• Prognosis for normal BV – usually guarded, but exceptions
• Consult with Peds-OD before surgeon
  – Although not best surgical candidates, some benefit cosmetically

Sensory Esotropia

• 2nd most common presenting sign of retinoblastoma
• DFE should be performed at 1st visit for all tropias

Abduction Deficits

• 6th nerve palsy
• Duane’s Syndrome I
Abducens (VI CN) Paresis
Clinical Characteristics

- Noncomitant ET
- Abduction deficit
- Esotropia
  - Largest in affected field of gaze
  - Larger with affected eye fixing
  - Not always tropic
- ± Horizontal face turn toward involved eye

<table>
<thead>
<tr>
<th>CN Palsy</th>
<th>Trauma</th>
<th>Congenital</th>
<th>Neoplasm</th>
<th>Postviral</th>
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<tr>
<td>VI*</td>
<td>3</td>
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<td>2</td>
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<td>4</td>
<td>0</td>
<td>12</td>
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</table>

*Holmes et al. JAO 1999;127:388-92 – Incident cases in children

Ddx VI Nerve Paresis

- Comitancy testing
- Other neurological signs ?
  - Papilledema
  - Optic neuropathy
  - Hemiparesis
  - Hx of metastatic CA

VI Nerve Paresis: Management

- Neuro consult
- If suspect head trauma - check for signs of child abuse
- Surgery - postpone at least 6 months
- Refer to Peds OD in meantime
  - Prisms, VT – esp. monoc abduction

Duane Retraction Syndrome: Type 1

+ Abduction: limitation or absence
+ Adduction:
  + Retraction of globe
  + Narrowing of palpebral fissure
  ± Upshoot or downshoot
± ET 1° gaze; Face turn toward involved eye

Duane Retraction Syndrome I
**Duane’s: Management**

- Objectionable head turn or ET in primary gaze?
  - NO → no treatment; reassurance
  - YES → refer Peds OD
    - Prism
    - Vision therapy
    - Surgery

**Esotropia: Sequential Treatment Plan**

**Phase 1: Establish Initial Optical Rx**

- Rx optimum lenses that:
  - Correct refractive error
  - Maximally reduce size of ET (D & N)
- Distance SRx – push plus (age dependent)
- Consider plus add for near
- Consider prism IF normal sensory fusion

**ET: Guidelines for Rxing Lenses**

- Hyperopia – Most plus to correct ametropia & decrease eso at D/N
  - ≤ 5-6 yrs full cyclo (usually works)
  - ≥ 7 yrs max plus without distance blur accepted
- Myopia - least minus to BVA
- Anisometropia - full Rx
- Astigmatism - full Rx
- CE ET - Bifocal
ET: Guidelines for Rxing Lenses

• If ET & cannot accept full distance plus, consider:
  – Cut distance and give add
  – Cyclotherapy
  – Gradual change in Rx (specs or CLs)

Optical Rx: Consider Bifocals for ET

• Plus Add at Near
  – Calculated AC/A ratio
  – Cover testing at near
  – +3.00D if young child
• Flat-top 28 typically

BIFOCAL HEIGHT

Age (Years)  Bifocal height*
< 5  Mid-pupil
6-7  Lower pupil margin
≥ 8-9  Lower lid margin or PAL

Age (Yrs)  PAL height*
< 7  4mm above mid pupil
≥ 8  2mm above mid pupil

*Caloroso & Rouse, Clinical Management of Strabismus, 2007

Lens Correction: General Guidelines

• Young kiddo’s ability to adapt to new optical correction totally different from adults
• Age: BV more important than emmetropization
• Consider CL’s for significant aniso

Optical Rx: Consider Prism

• Only if normal sensory fusion!
• Horizontal relieving prism only if BV can be established/stabilized in free space
  – Smallest magnitude to achieve fusion
  – For 6-20∆ ET, leave residual vergence demand of 4-6∆*

Follow-up: 4-6 weeks Post Optical Rx

• Evaluate sensory fusion
  – Stereopsis: RDS preferable ++
  – 2° fusion (Worth Dot / Peds flashlight)
• Cover testing
• If residual ET, revaluate fusion with ∆

*Caloroso's residual vergence demand criterion for esodeviations
Caloroso & Rouse, Clinical Management of Strabismus, 1997
Follow-up: 4-6 weeks post Optical Rx

- Evaluate sensory fusion
  - Stereopsis: RDS preferable ++
  - 2° fusion with Worth Dot or Peds flashlight (w/ & w/o prism if residual ET)
- Cover testing
- Over refraction & Visual Acuity
  - May need repeat cycloplegic refraction
  - Treat amblyopia (if applicable) (Phase 2)
  - If not amblyopic: correspondence & in-instrument sensory fusion evaluation**

Phase 2: Improve Monocular Visual Function

- Treat amblyopia
- Normalize accommodation

Amblyopia: Refractive Correction Guidelines

- Based on 1% cyclopentolate refraction
- Full anisometropia, astigmatism, myopia
- Hyperopia
  - Fully correct (primarily for ET)
  - Under-correct symmetrically*

Evidence-Based, Step-Wise Management Strategy for Amblyopia

| Moderate amblyopia due to anisometropia and/or strabismus |
| Spectacle correction; FU every 4-8 weeks until no further improvement |
| If persists, initiate additional treatment (2 hrs daily patching, weekend atropine, or Bangerter filter); FU every 4-8 wks until no further improvement |
| If persists, consider increasing patching from 2 to 6 hours daily* Follow every 4-8 weeks until no further improvement |
| When maximum VA, taper or stop treatment & monitor for amblyopia recurrence |

* Alternatives: changing to atropine or Bangerter filter

*no more than 1.50 D for most PEDIG studies

Sequential Management

Primary Core

1. Optimum Initial Prescription
2. Improve Monocular Visual Function
3. Develop Sensory & Motor Fusion
4. Establish Binocular Vision in Free Space

Phase 3

- Eliminate anomalous correspondence
- Eliminate peripheral suppression
- Develop Normal Peripheral SMF
- Improve/stabilize peripheral sensory fusion & increase motor fusion
How About Surgery?

What are the Indications?

- Best surgical candidates:
  - Wearing maximum hyperopic correction
  - No to minimal amblyopia
  - Normal sensory fusion
  - Good motor fusion around <D

- Post-surgical follow-up

Surgery for Esotropia

Phases 3 & 4

Conclusions

- All ET’s are not created equal
- Prognosis depends on many things, including:
  - History / age
  - Diagnostic profile / type of ET
  - Treatment(s) to be undertaken
- Optimal refractive correction is essential
- Amblyopia should be eliminated
- Identify a local Peds OD & Peds ophthalmologist to work with

Strabismus Surgery

Post Surgery

- Consider lenses, prism, VT if indicated

Thank You!

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