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One useful way to classify esotropia is with respect to comitance. A comitant ET is one in which the magnitude (in prism-diopters) of the esotropia is the same in all fields of gaze. For example, the run-of-the-mill ET typically found in a very young child is usually comitant.

*(Prism-diopters are represented by a delta $\Delta$; eg, $50\Delta = 50$ prism-diopters)*
Comitant Esotropia

~50Δ of comitant esotropia
Comitant Esotropia

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Comitant Esotropia

Huge ET in right gaze
Moderate ET in primary gaze
Almost no ET in left gaze

Incomitant ET 2ndry to right CN6 palsy
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This slide-set will focus on comitant ET. There is no gender predilection for comitant ET; however, there is a racial one: Incidence in White and Black infants is roughly equal, and both are higher than that for infants of Asian descent.
This is the first step in how we think about comitant ET: Whether it presented congenitally (defined as before age 6 months) or whether it was acquired (later than age 6 months).
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It’s important to note here that brief strabismic episodes are commonly seen in the first few (especially two) months of life. Further, it’s not uncommon for the same infant to manifest short periods of both ET and XT; this is referred to as *ocular instability of infancy*. 
This is the first step in how we think about comitant ET: Whether it presented congenitally (defined as before age 6 months) or whether it was acquired (later than age 6 months). Note that *congenital* is a misnomer here in that, technically, a congenital disorder must be present at birth—it can’t show up 6 months later. (For this reason, some clinicians refer to these cases not as ‘congenital,’ but rather as *infantile* esotropia.)

It’s important to note here that brief strabismic episodes are commonly seen in the first few (especially two) months of life. Further, it’s not uncommon for the same infant to manifest short periods of both ET *and* XT; this is referred to as *ocular instability of infancy*. However, if the ET is 1) present after age 2 months; 2) constant; and/or 3) large, it probably represents a congenital ET.
We divvy congenital ET into two groups: Those presenting with nystagmus, and those presenting without it.
Comitant Esotropia

Congenital (onset < age 6 m)  Acquired (onset > age 6 m)

With nystagmus  W/o nystagmus

**Congenital ET without nystagmus** is your garden-variety 'my baby’s eyes have been crossed since birth' esotropia. The deviation tends to be large—30Δ or more. A family history is often present.
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If vision is equal bilaterally, these infants frequently employ cross fixation, meaning they will use their (crossed) right eye to look at objects to their left, and their (crossed) left eye to look at those to the right.
Comitant Esotropia

ET with cross-fixation
Comitant Esotropia

- Congenital (onset < age 6 m)
  - W/o nystagmus
  - With nystagmus

- Acquired (onset > age 6 m)

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On the other hand, if amblyopia has rendered one eye better-seeing (a common occurrence), the infant will display a gaze preference for that eye.
Congenital (onset < age 6 m)  Acquired (onset > age 6 m)

With nystagmus  **W/o nystagmus**

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Another common finding in these infants is *dissociated vertical deviation* (DVD), the phenomenon in which one eye slowly elevates and extorts. This may occur spontaneously (*manifest DVD*), or only when the eye is occluded (*latent DVD*).
Comitant Esotropia

(Latent) DVD
Comitant Esotropia

For more on DVD, see slide-set P7 (see also the set concerning Sherrington’s and Hering’s law, FELT3)
Congenital (onset < age 6 m)  

With nystagmus  

W/o nystagmus  

Acquired (onset > age 6 m)  

Comitant Esotropia

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Management of congenital ET w/o nystagmus is usually surgical via bilateral medial rectus recession. It is generally agreed that surgery should occur before the child’s 2nd birthday if possible.
Comitant Esotropia

Congenital (onset < age 6 m)  Acquired (onset > age 6 m)

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Comitant Esotropia

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  - W/o nystagmus
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- Acquired (onset > age 6 m)
  - With nystagmus

- W/o nystagmus

Management of congenital ET w/o nystagmus is usually surgical via bilateral medial rectus recession. It is generally agreed that surgery should occur before the child’s 2nd birthday if possible. High-grade stereopsis is not a realistic outcome to expect; rather, monofixation syndrome is the hope-for outcome.

In order to both prevent diplopia and provide some degree of binocular cooperation, the immature visual system responds to strabismus with some combination of three adaptations:

- **Suppression**
  - refers to the prevention of an image in one eye from reaching conscious awareness.
  - It is one of the three sensory adaptations to strabismus that was mentioned previously.

- **Anomalous retinal correspondence (ARC)**
  - is the development of a common visual direction between noncorresponding locations on the two retinas; eg, in ET the fovea in one eye will ‘align’ with a macular location in the fellow eye that is nasal to its fovea.

- **Monofixation syndrome**
  - is a condition in which the pt develops a combination of a small-angle ET along with a small suppression scotoma.
Comitant Esotropia

- Congenital (onset < age 6 m)
  - With nystagmus
  - W/o nystagmus

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**Comitant Esotropia**

- **Congenital (onset < age 6 m)**
  - W/o nystagmus
  - With nystagmus

- **Acquired (onset > age 6 m)**

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**For more on sensory adaptations to strabismus, see slide-set P14**

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Comitant Esotropia

Congenital (onset < age 6 m)  Acquired (onset > age 6 m)

With nystagmus  W/o nystagmus

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For more on nystagmus, see slide-set P4
Comitant Esotropia

Congenital (onset < age 6 m)  Acquired (onset > age 6 m)

With nystagmus  W/o nystagmus

- Nystagmus blockage syndrome
- Latent nystagmus
- Ciancia syndrome

The *Peds/Strabismus* book covers these three forms of **congenital ET with nystagmus**
Comitant Esotropia

Congenital (onset < age 6 m)  Acquired (onset > age 6 m)

With nystagmus  W/o nystagmus

Nystagmus blockage syndrome  Latent nystagmus  Ciancia syndrome

Nystagmus blockage syndrome is the esotropia that develops in pts with congenital motor nystagmus (CMN).
Comitant Esotropia

Congenital (onset < age 6 m)  Acquired (onset > age 6 m)

With nystagmus  W/o nystagmus

- Nystagmus blockage syndrome
- Latent nystagmus
- Ciancia syndrome

Nystagmus blockage syndrome is the esotropia that develops in pts with congenital motor nystagmus (CMN). CMN is a form of nystagmus that arises in the first few months of life. Unlike most forms of nystagmus, it is not secondary to either vision loss or CNS pathology—it just kinda 'is.'
Comitant Esotropia

Congenital (onset < age 6 m)  Acquired (onset > age 6 m)

With nystagmus  W/o nystagmus

- **Nystagmus blockage syndrome**
- Latent nystagmus
- Ciancia syndrome

**Nystagmus blockage syndrome** is the esotropia that develops in pts with *congenital motor nystagmus (CMN)*. CMN is a form of nystagmus that arises in the first few months of life. Unlike most forms of nystagmus, it is not secondary to either vision loss or CNS pathology— it just kinda ‘is.’ Pts with congenital motor nystagmus usually have pretty good vision (rule of thumb: If a pt has nystagmus + good VA, it’s probably CMN). It is virtually always horizontal.
Congenital (onset < age 6 m)  
Acquired (onset > age 6 m)

With nystagmus  
W/o nystagmus

- Nystagmus blockage syndrome
- Latent nystagmus
- Ciancia syndrome

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So why does CMN lead to esotropia? Because early in life, the visual system ‘realizes’ that the nystagmus is minimized (and thus acuity is maximized) when the eyes are converged.
Comitant Esotropia

Congenital (onset < age 6 m)  Acquired (onset > age 6 m)

With nystagmus  W/o nystagmus

- Nystagmus blockage syndrome
- Latent nystagmus
- Ciancia syndrome

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So why does CMN lead to esotropia? Because early in life, the visual system ‘realizes’ that the nystagmus is minimized (and thus acuity is maximized) when the eyes are converged. Because of this, the system learns to adopt and maintain an esotropic posture.
Comitant Esotropia

Congenital (onset < age 6 m)  Acquired (onset > age 6 m)

With nystagmus  W/o nystagmus

- Nystagmus blockage syndrome
- Ciancia syndrome
- Latent nystagmus

Latent nystagmus is an interesting phenomenon in which no nystagmus is present when vision is binocular, but commences if/when one eye is occluded.
Comitant Esotropia

Congenital (onset < age 6 m)  Acquired (onset > age 6 m)

With nystagmus  W/o nystagmus

- Nystagmus blockage syndrome
- Latent nystagmus
- Ciancia syndrome

Ciancia syndrome has two features that give it away: The first is, the ET is very large—usually $50\Delta$ or more. Second, the nystagmus intensifies if the pt attempts to abduct either eye.
Comitant Esotropia

Ciancia syndrome
Comitant Esotropia

Congenital (onset < age 6 m)
- With nystagmus
  - Nystagmus blockage syndrome
  - Latent nystagmus
  - Ciancia syndrome
- W/o nystagmus

Acquired (onset > age 6 m)
- Accommodative
- Nonaccommodative
  
**Acquired ET** is also divvied two groups: Those that are *accommodative* in nature, and those that are *nonaccommodative*.
Accommodative esotropia refers to ET stemming from activation of the accommodative (aka near) reflex. Recall that the accommodative reflex has three components: accommodation, miosis, and convergence. Recall further that accommodation refers to the cranking in of lenticular ‘plus’ power to overcome hyperopic blur.
**Comitant Esotropia**

- **Congenital (onset < age 6 m)**
  - With nystagmus
  - W/o nystagmus

- **Acquired (onset > age 6 m)**
  - **Accommodative**
  - **Nonaccommodative**

**Accommodative esotropia** refers to ET stemming from activation of the *accommodative* (aka *near*) *reflex*. Recall that the accommodative reflex has three components: *accommodation*, *miosis*, and *convergence*. Recall further that *accommodation* refers to the cranking in of lenticular ‘plus’ power to overcome hyperopic blur. Under normal circumstances, the convergence component of the triad is offset by ‘divergence inputs’ via supranuclear pathways that tend to push the eyes apart. For most kids, the net effect of accommodation-induced convergence *and* supranuclear-induced divergence is orthotropia, ie, both eyes pointed at the object of regard.
**Accommodative esotropia** refers to ET stemming from activation of the accommodative (aka near) reflex. Recall that the accommodative reflex has three components: accommodation, miosis, and convergence. Recall further that accommodation refers to the cranking in of lenticular ‘plus’ power to overcome hyperopic blur. Under normal circumstances, the convergence component of the triad is offset by ‘divergence inputs’ via supranuclear pathways that tend to push the eyes apart. For most kids, the net effect of accommodation-induced convergence and supranuclear-induced divergence is orthotropia, ie, both eyes pointed at the object of regard. However, in kids with accommodative ET, the convergence input overwhelms the divergence offset, and the eyes end up esotropic.
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Accommodative ET typically arises around age 2-3 years. It is intermittent initially, eventually progressing to become constant. The child will often complain of diplopia at first, but stops after developing a facultative suppression scotoma. (A facultative suppression scotoma is one that is active only while the eye is deviated.) Amblyopia is common.
Comitant Esotropia

Congenital (onset < age 6 m)

- With nystagmus
  - Nystagmus blockage syndrome
  - Latent nystagmus
  - Ciancia syndrome
- W/o nystagmus

Acquired (onset > age 6 m)

Accommodative ET is further divvied into two forms: **Refractive** and **Nonrefractive**
Comitant Esotropia

Congenital (onset < age 6 m)
- With nystagmus
  - Nystagmus blockage syndrome
  - Latent nystagmus
  - Ciancia syndrome
- W/o nystagmus

Acquired (onset > age 6 m)
- Accommodative
- Nonaccommodative
  - Accommodative
  - Nonrefractive

Refractive accommodative esotropia is pretty straightforward: It is due primarily to being a high hyperope (average ~4D). For these kids, the severe accommodative exertion required to overcome their hyperopia stimulates so much convergence (via the near reflex) that their divergence inputs get swamped, and their eyes turn in.
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Refractive accommodative ET is managed by prescribing the full cycloplegic refraction, which should eliminate the accommodation→convergence→ET chain at the source. If residual ET’ is present, a bifocal should be employed.
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Refractive accommodative ET is managed by prescribing the full cycloplegic refraction, which should eliminate the accommodation→convergence→ET chain at the source. If residual ET' is present, a bifocal should be employed. Over time, the plus power should be weaned off as tolerated (by the child's eyes remaining straight).
The mechanism underlying **nonrefractive accommodative esotropia** is less straightforward. As in its refractive cousin, nonrefractive accommodative esotropia is secondary to convergence induced by accommodation for which divergence inputs are insufficient to keep the eyes straight.
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We have noted several times now that the near reflex yokes convergence to accommodation. As would be expected, the amount of convergence stimulated by the near reflex is proportional to the amount of accommodation needed to see something—simply put, closer objects require more accommodation to be seen clearly, and because they’re closer, they require more convergence to be bifixated.
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Congenital (onset < age 6 m)  
- With nystagmus  
  - Nystagmus blockage syndrome  
  - Latent nystagmus  
  - Ciancia syndrome  
  - W/o nystagmus  

Acquired (onset > age 6 m)  
- Accommodative  
- Nonaccommodative  
  - Accommodative  
    - Refractive  
    - Nonrefractive

The mechanism underlying non-refractive accommodative esotropia is less straightforward. As in its refractive cousin, nonrefractive accommodative esotropia is secondary to convergence induced by accommodation for which divergence inputs are insufficient to keep the eyes straight. However, the underlying issue is not one of high hyperopia per se, but rather of a clinical issue called a high AC/A ratio. Let’s unpack this important concept.

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Comitant Esotropia

Congenital (onset < age 6 m)

- W/o nystagmus
  - Nystagmus blockage syndrome
  - Latent nystagmus
  - Ciancia syndrome
- With nystagmus

Acquired (onset > age 6 m)

- Accommodative
- Nonaccommodative
  - Refractive
  - Nonrefractive

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How best to manage high AC/A ratio accommodative esotropia is unsettled as of this writing. Some specialists elect observation so long as the child’s eyes are pretty straight at distance. Others argue that bifocals are worth a try, provided you ensure the kid actually uses the add appropriately. Surgical correction can be countenanced, but is labeled “controversial” by the Peds book. While the ideal outcome would obviously be resolution of the ET at both distance and near, most specialists could live with a small amount (<10Δ) of ET at near.
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Comitant Esotropia

Congenital (onset < age 6 m)
- With nystagmus
  - Nystagmus blockage syndrome
  - Latent nystagmus
  - Ciancia syndrome
- W/o nystagmus

Acquired (onset > age 6 m)
- Accommodative
  - Refractive
  - Nonrefractive
- Nonaccommodative
  - Basic
  - Sensory
  - Divergence insufficiency
  - Spasm of the near
  - Consecutive
  - Cyclic

The *Peds* book discusses several forms of acquired nonaccommodative esotropia.
Comitant Esotropia

Congenital (onset < age 6 m)
- With nystagmus
  - Nystagmus blockage syndrome
  - Latent nystagmus
  - Ciancia syndrome
- W/o nystagmus

Acquired (onset > age 6 m)
- Accommodative
- Nonaccommodative
  - Basic
  - Sensory

**Basic nonaccommodative esotropia** is, in essence, the acquired version of congenital esotropia w/o nystagmus: The child is not a high hyperope, and the size of the deviation is similar distance and near.
Basic nonaccommodative esotropia is, in essence, the acquired version of congenital esotropia w/o nystagmus: The child is not a high hyperope, and the size of the deviation is similar distance and near. Management consists of patching (if needed, to sweeten up VA if amblyopia has set in), followed by surgical intervention for the full prism-adapted deviation.
Comitant Esotropia

- **Congenital (onset < age 6 m)**
  - With nystagmus
  - W/o nystagmus
    - Nystagmus blockage syndrome
    - Latent nystagmus
- **Acquired (onset > age 6 m)**
  - Accommodative
  - Nonaccommodative
    - Basic
      - Sensory

**Prism adaptation** is a process in which the pt is prescribed the full prism needed to nullify their ET, then re-evaluated periodically to determine whether additional ET has been ‘uncovered.’ If it has, the prescription is updated to nullify the additional ET. **Prism-adapted deviation.**
Comitant Esotropia

Congenital (onset < age 6 m)

- With nystagmus
  - Nystagmus blockage syndrome
  - Latent nystagmus

- W/o nystagmus

Acquired (onset > age 6 m)

- Accommodative
- Nonaccommodative

Basic nonaccommodative esotropia is, in essence, the acquired version of congenital esotropia w/o nystagmus: The child is not a high hyperope, and the size of the deviation is similar distance and near. Management consists of patching (if needed, to sweeten up VA if amblyopia has set in), followed by surgical intervention for the full prism-adapted deviation.

If there is anything hinky about the presentation (eg, any neuro signs/symptoms; face turn; c/o HA), imaging should be obtained.

Prism adaptation is a process in which the pt is prescribed the full prism needed to nullify their ET, then re-evaluated periodically to determine whether additional ET has been 'uncovered.' If it has, the prescription is updated to nullify the additional ET. This is repeated until the prism prescription is stable, at which time surgery is performed to correct the full final prism prescription.
Basic nonaccommodative esotropia is, in essence, the acquired version of congenital esotropia w/o nystagmus: The child is not a high hyperope, and the size of the deviation is similar distance and near. Management consists of patching (if needed, to sweeten up VA if amblyopia has set in), followed by surgical intervention for the full prism-adapted deviation. 

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Comitant Esotropia

Congenital (onset < age 6 m)
- With nystagmus
  - Nystagmus blockage syndrome
  - Latent nystagmus
  - Ciancia syndrome
- W/o nystagmus

Acquired (onset > age 6 m)
- Accommodative
  - Refractive
  - Nonrefractive
- Nonaccommodative
  - Basic
  - Sensory
    - Divergence insufficiency
    - Spasm of the near

**Sensory (aka deprivational) nonaccommodative esotropia** develops in response to monocular vision loss. Common causes include cataracts, corneal clouding, and retinal or optic nerve disorders. The lack of symmetric visual stimulation leads to amblyopia, followed by a breakdown in fusion.
Earlier in this slide-set we mentioned supranuclear divergence inputs that prevent overconvergence. In divergence insufficiency, a lack of robustness on the part of these inputs allows the eyes to turn in a bit, resulting in a modest esotropia.
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Note that these conditions can be differentiated on the basis of the relative magnitude of the esotropia as a function of whether it is measured at distance vs near:

- **Accommodative refractive esotropia**: $ET \approx ET'$
- **Accommodative nonrefractive (high AC/A ratio) esotropia**: $ET < ET'$
- **Divergence insufficiency**: $ET > ET'$
Earlier in this slide-set we mentioned supranuclear divergence inputs that prevent overconvergence. In **divergence insufficiency**, a lack of robustness on the part of these inputs allows the eyes to turn in a bit, resulting in a modest esotropia. The classic presentation is that of an esotropia that is present at distance, but not at near. **The most common form of this develops in older individuals**—hence its alternative name, *age-related distance esotropia*. In some pts, imaging reveals age-related structural changes to the EOMs or orbital ligamentous support structures. Prisms, Botox injection, and surgery have all proven safe and effective interventions.
Spasm of the near (aka convergence spasm) is almost always a functional response to psychosocial stressors. All three components of the near triad (convergence, miosis and accommodation) can usually be demonstrated. The esotropia may alternate with periods of orthotropia. Abduction will be poor or absent when the eyes are tested simultaneously, but full when tested monocularly.
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Consecutive esotropia refers to esotropia that develops in someone with a history of exotropia. In almost all cases, consecutive esotropia is post-surgical, ie, it represents an apparent overcorrection in someone who underwent strab surgery for exotropia.
**Comitant Esotropia**

**Congenital (onset < age 6 m)**

- With nystagmus
  - Nystagmus blockage syndrome
  - Latent nystagmus
  - Ciancia syndrome
- W/o nystagmus

**Acquired (onset > age 6 m)**

- Accommodative
  - Refractive
  - Nonrefractive
- Nonaccommodative
  - Basic
  - Sensory
  - Divergence insufficiency
  - Spasm of the near
  - **Consecutive**
  - Cyclic

**Consecutive esotropia** refers to esotropia that develops in someone with a history of exotropia. In almost all cases, consecutive esotropia is post-surgical, ie, it represents an apparent overcorrection in someone who underwent strab surgery for exotropia. That said, consecutive esotropia often resolves spontaneously, so unless it is very large (in which case it likely represents a slipped/lost muscle), observation is usually the preferred management option.
**Comitant Esotropia**

- **Congenital (onset < age 6 m)**
  - With nystagmus
    - Nystagmus blockage syndrome
    - Latent nystagmus
    - Ciancia syndrome
  - W/o nystagmus
- **Acquired (onset > age 6 m)**
  - Accommodative
    - Refractive
    - Nonrefractive
  - Nonaccommodative
    - Basic
    - Sensory
    - Divergence insufficiency
    - Spasm of the near
    - Consecutive
    - **Cyclic**

**Cyclic esotropia** is a rare disorder in which a comitant ET is present intermittently, usually every other day. The typical pt is pre-school age. Surgical correction of the maximum observed ET is the treatment of choice.
That's it! Go through this slide-set a couple of times (at least) until you feel like you have a handle on it. When you’re ready, do slide-set P5, which covers this material in a Q&A format (and more detail).