Managing Vertical Strabismus

Justin Mora

• To appropriately manage a problem it is ideal to have a diagnosis

• So the key to managing vertical strabismus is to find why the eyes are sitting at different heights.
• History
  – Lifelong / new onset – sudden vs gradual
  – Constant / intermittent
  – Diplopia - if so in what gaze positions?
  – Previous trauma, previous surgery
• Prism in specs or not
• General features
  – head tilt, facial asymmetry, craniofacial abnormalities
• And then you need an approach to the examination...

• That can you use for an obvious problem like this

• But will also be useful even for a subtle case like this
A few thoughts...

- Most purely horizontal strabismus arises due to a weakness in the alignment system, a fusional problem
  - Infantile ET
  - Accommodative ET
  - Intermittent XT
  - But there are quite a few exceptions: 6th nerve palsy, Duane, slipped muscles, trauma to horizontal recti

- Most vertical strabismus arises due to a nerve or muscle problem and there are few exceptions

Muscle/nerve causes of vertical strabismus

- 4th nerve palsy
- Partial 3rd nerve palsy
- Orbital floor fracture
- Post cataract surgery
- Thyroid eye disease
- DVD
- Brown syndrome
- Double elevator palsy
- CFEOM
- Skew deviation
- Inferior oblique inclusion syndrome
- Inferior oblique palsy
- Duane with upshoot/downshoot
- Myasthenia
- Parinauds
- Craniofacial abnormalities
- Penetrating trauma / Fat adherence syndrome
Most horizontal strabismus is therefore largely comitant
  – The angle of deviation is the same in all gaze directions

While almost all vertical strabismus is incomitant
  – The angle of deviation differs significantly in different gaze directions

Incomitant causes of vertical strabismus

- 4th nerve palsy
- Partial 3rd nerve palsy
- Orbital floor fracture
- Post cataract surgery
- Thyroid eye disease
- DVD
- Brown syndrome
- Double elevator palsy
- CFEOM
- Skew deviation
- Inferior oblique inclusion syndrome
- Inferior oblique palsy
- Duane with upshoot/downshoot
- Myasthenia
- Parinauds
- Craniofacial abnormalities
- Penetrating trauma / Fat adherence syndrome
Comitant causes of vertical strabismus

- 4th nerve palsy (longstanding with spread of comitance)
- Partial 3rd nerve palsy
- Orbital floor fracture
- Post cataract surgery
- Thyroid eye disease
- DVD
- Brown syndrome
- Double elevator palsy
- CFEOM
- Skew deviation

- Inferior oblique inclusion syndrome
- Inferior oblique palsy
- Duane with upshoot/downshoot
- Myasthenia
- Parinauds
- Craniofacial abnormalities
- Penetrating trauma / Fat adherence syndrome

So the first step is to work out which muscle(s) or nerve(s) is at fault

That starts with deciding if it is the higher eye or the lower eye that is abnormal
- **Higher eye abnormal**
  - 4th nerve palsy
  - Partial 3rd nerve palsy (inferior branch)
  - Inferior rectus weakness
  - DVD

- **Lower eye abnormal**
  - Congenital double elevator palsy
    - Partial 3rd nerve palsy (superior branch), CFEOM
  - Acquired tight inferior rectus – TED, floor #, fat
  - Brown syndrome

The abnormal muscle will have abnormal movement so don’t make any assumptions until you have fully assessed the movements

- Don’t assume that the fixing eye is the normal eye
- A patient may fix with a palsied eye if it has better vision
• Eye movements abnormalities
  – Limited elevation
  – limited depression
  – Oblique dysfunction – underaction, overaction
  – Secondary overaction
• Examining movements
  – Don’t rush and don’t have target too close
  – Go to extremes of gaze positions
  – Lift lids if necessary but note any abnormal lid movements first
  – Remember ductions and look for limitations/overactions

Limitations of eye movements

• How to distinguish Palsy  vs  Restriction
• Saccadic velocities
• Sudden/slow stop
• Force generation
• Forced ductions
• Botox
‘Palsy’ causes of vertical strabismus

- 4th nerve palsy
- Partial 3rd nerve palsy
- Orbital floor fracture
- Post cataract surgery
- Thyroid eye disease
- DVD
- Brown syndrome
- Double elevator palsy
- CFEOM
- Skew deviation

- Inferior oblique inclusion syndrome
- Inferior oblique palsy
- Duane with upshoot/downshoot
- Myasthenia
- Parinauds
- Craniofacial abnormalities
- Penetrating trauma / Fat adherence syndrome

Restrictive causes of vertical strabismus

- 4th nerve palsy
- Partial 3rd nerve palsy
- Orbital floor fracture
- Post cataract surgery
- Thyroid eye disease
- DVD
- Brown syndrome
- Double elevator palsy
- CFEOM
- Skew deviation

- Inferior oblique inclusion syndrome
- Inferior oblique palsy
- Duane with upshoot/downshoot
- Myasthenia
- Parinauds
- Craniofacial abnormalities
- Penetrating trauma / Fat adherence syndrome
- Any longstanding deviation can result in a tight antagonist and restriction
Forced duction testing in the office

- Suction device applied with topical anaesthetic
- Good for horizontal FDT and FGT
- FDT - Have patient look in gaze direction of interest and move the device in the same direction
- FGT – Move in opposite direction
- Quite comfortable for the patient compared with forceps

- www.sightforall.org

- A$115
What is the role of the 3 step test in vertical strabismus?

- 4th nerve palsy
- Partial 3rd nerve palsy
- Orbital floor fracture
- Post cataract surgery
- Thyroid eye disease
- DVD
- Brown syndrome
- Double elevator palsy
- CFEOM
- Skew deviation
- Inferior oblique inclusion syndrome
- Inferior oblique palsy
- Duane with upshoot/downshoot
- Myasthenia
- Parinauds
- Craniofacial abnormalities
- Penetrating trauma / Fat adherence syndrome

To diagnose paralytic strabismus only

- 4th nerve palsy
- Partial 3rd nerve palsy
- Orbital floor fracture
- Post cataract surgery
- Thyroid eye disease
- DVD
- Brown syndrome
- Double elevator palsy
- CFEOM
- Skew deviation
- Single muscle SR or IR palsy
- Inferior oblique inclusion syndrome
- Inferior oblique palsy
- Duane with upshoot/downshoot
- Myasthenia
- Parinauds
- Craniofacial abnormalities
- Penetrating trauma / Fat adherence syndrome
How does the 3 step test work for a right 4th nerve palsy?

- Which eye is higher in primary position?
  - RE due to weakness of RSO depressor

- RE higher in ....... gaze
  - Left
  - Weak RSO, overaction of the RIO

- RE higher in ....... tilt
  - Right
  - Weak RSO so tilt is compensated for by the other ocular intorter, the RSR and the eye elevates further

Case Studies
Brown Syndrome

- 3 grades / levels of severity
  - Grade 1 – limitation of elevation in adduction
  - Grade 2 – plus downshoot on adduction
  - Grade 3 – plus primary position hypotropia

- Indications for surgery – uncommonly required
  - Primary position hypotropia affecting fusion
  - Unacceptable abnormal head posture
  - Unacceptable downshoot

- Surgical options
  - SO tendon expansion
  - SO tenotomy - 30% overcorrection needing IO weakening

Duane with Upshoot

- Caused by co-contraction and muscle rolling over the globe

- Y-split of recessed lateral rectus
• Indications for surgery for Duane syndrome
  – significant face turn
  – significant primary position deviation
  – marked enophthalmos
  – marked upshoot / downshoot
  – diplopia

Dissociated Vertical Deviation

• How to distinguish from IOOA?
  – Present in abduction
  – No contralateral hypotropia
  – Slow /drifting recovery with torsional component
  – No ‘V’ pattern

• Indications for surgery
  – Cosmetically poor

• Surgical options
  – Large (6mm) SR recession
  – IO anterior transposition (with IOOA or as prophylaxis)
  – IR resection if persistent/recurrent
TED Management

- Prednisone or pulsed MP can be helpful in reducing swelling and discomfort while still active
- Stability is preferable before surgery
- Ideally
  - No injection, chemosis
  - Document no change in squint for 6 months
- But.....
  Coats et al have shown that in cases with a major functional deficit satisfactory outcomes can be achieved even in the presence of active disease

Surgical planning

- Need to measure and correct horizontal, vertical and torsional components
  - Duction limitations
  - PCT for near and distance, horizontal and vertical
  - Torsion with double Maddox Rod in primary and downgaze
  - Scanning to confirm muscle involvement
Double elevator palsy

- Weakness of elevation / tight IR
- Dysinervation syndrome / CFEOM type 1
- MR scan to look at SR complex
- FDTs
- Very large IR recession + vertical transposition
SO Palsy

- **Aetiology**
  - Congenital – AHP, facial asymmetry, large fusion range, may breakdown later in life
  - Acquired – trauma/vascular, diplopia, torsion more symptomatic

- **Bilateral**
  - alternating hypertropia, torsion > 15°, large V pattern with downgaze ET, chin down posture

- **Indications for intervention**
  - Loss of fusion
  - Diplopia
  - AHP
  - Cosmetically unacceptable
Third Nerve Palsy

- Partial
  - Recess/Resect with contralateral LR posterior fixation
- Complete
  - SO transposition to relieve unopposed torsion
  - LR to lateral orbital wall
  - LR nasal transposition
  - Medial orbital wall fixation