

Diplopia: Evaluation and Management

Marie I. Bodack, OD, FAAO, FCOVD, Dipl BVPPPO
 Southern College of Optometry
 Memphis, TN, USA
 mbodack@sco.edu

Course Goals

- ▶ To help practitioners take a thorough history on patients who present with a complaint of diplopia.
- ▶ To review optometric testing on these patients that will help differentiate pathologic from non-pathologic etiologies of diplopia.
- ▶ To discuss treatment options, including indications for additional testing, and referrals to specialists, if indicated.

▶ Nothing to disclose

Questions

- ▶ Is it truly DIPLOPIA or BLUR?
- ▶ WITH or WITHOUT glasses?
- ▶ Does diplopia go away when EITHER eye is covered? ▶ *Is diplopia HORIZONTAL or VERTICAL?*
- ▶ *Is diplopia greater at DISTANCE or NEAR?* ▶ *Is diplopia greater in RIGHT or LEFT gaze?* ▶ When was the onset?
- ▶ Associated signs/symptoms
 - ▶ Headache, nausea, behavior changes
- ▶ Medical history/Medications

Diplopia Testing

▶ Motilities

(Diplopia) Testing Disclosures

- ▶ Visual Acuity with Pinhole - Pupils
- ▶ Visual Field

Neuro

- ▶ Restriction
- ▶ Cover Test
- ▶ Near Point of Convergence (NPC)
- ▶ (Color)

- ▶ Parks 3 Step (Vertical)
- ▶ Maddox Rod/Red Lens
- ▶ Worth 4 Dot



Cornea/Lens Retinal/Neuro

- ▶ Anterior Segment
- ▶ Dilation

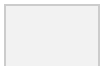
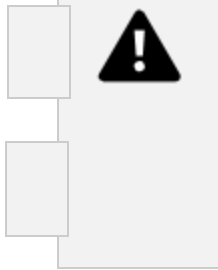
Cover Test

- ▶ Distance and Near
- ▶ 9 positions of gaze
 - ▶ At distance or near
- ▶ Sensorimotor Exam
 - ▶ Include Sensory Fusion
 - ▶ Interpretation and Report



Maddox Rod

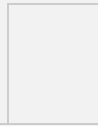
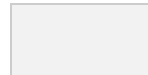
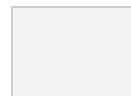
- ▶ EXO - line to the left of the light ▶ Base IN
- ▶ ESO - line to the right of the light ▶ Base OUT
- ▶ Hypertropic eye sees the LOWER image
- ▶ Base down



The Good

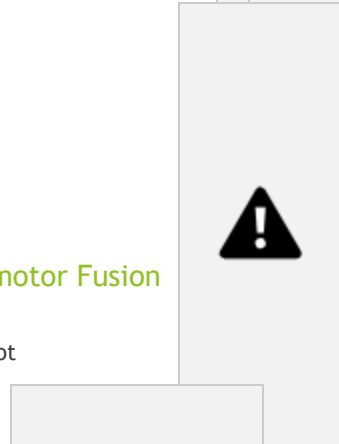
Maddox Rod

- ▶ Rod on Right eye for consistency
- ▶ Align with lines Vertical for Vertical diplopia ▶ Patient sees
- Horizontal line ▶ Align with lines Horizontal for Horizontal diplopia
- ▶ Patient sees Vertical Line



Sensorimotor Fusion

- ▶ Worth 4 Dot
 - ▶ Fusion
 - ▶ OD



- suppression
- ▶ OS suppression
- ▶ Diplopia
 - Eso = uncrossed
 - Exo = crossed
- ▶ Malingerer

- ▶ 48 y/o Male just picked up glasses and is seeing double
- ▶ Optical referred back to optometrist
- ▶ OD -4.00 20/20, OS -3.50 20/20
+1.50 Add 20/20
 - ▶ Refraction
 - ▶ Trial Frame

Example



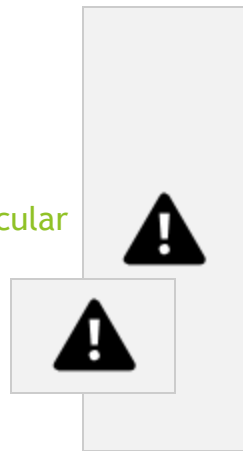
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Monocular Diplopia - Ocular Causes

- ▶ Optical
 - ▶ Bifocals, misaligned PALS
 - ▶ Astigmatism axis
- ▶ Uncorrected refractive error
 - ▶ Astigmatism
 - ▶ Corneal disease
 - ▶ Keratoconus, S/P LASIK
 - ▶ Lens changes

Key Test for Monocular diplopia

- ▶ If monocular due to aberration will go away with pinhole





Monocular Diplopia - Rarer Cause

- Macula disorders

The Bad

Monocular Diplopia - Neurological Causes (Rarer)

▸ Palinopsia

- Persistence/recurrence of visual images after removal of the stimulus
- Possible visual field defect
- Etiology: parieto occipital damage, trauma, medications ▸ Meadows & Munro. J Neuro, Neurosurg, Psych 1977, 40: 5-8 ▸ Abert & Ilksen. Optometry 2010, 81: 394-404

▸ Cerebral diplopia/polyopia

- Etiology: occipital lesions, migraine, epilepsy
- May have visual field defect

Patient
thinks Bad
Doctor can fix

= Good



Binocular Diplopia

- ▶ Can be due to strabismus or non-strabismic binocular vision disorder
- ▶ Diplopia or suppression when eyes not aligned
- ▶ Deviation should be comitant



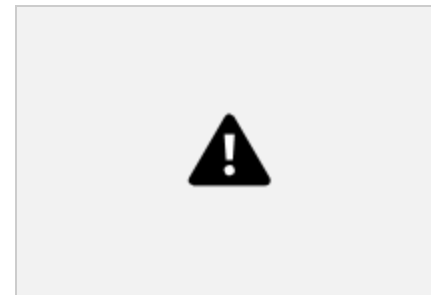
- ▶ Non-refractive
- ▶ Partially
- ▶ Onset: 6 mos to 8 years (3-4 years)

Accommodative Esotropia

- ▶ Complete resolution with full Rx
- ▶ Incomplete resolution (33%)
- ▶ Amblyopia
- ▶ Magnitude
- ▶ 70% 11-45^Δ
- ▶ Refractive error +2 to +6D
- ▶ Motor



IOOA



Accommodative esotropia

- ▶ Refractive
 - ▶ 35% IOOA
 - ▶ Not initially

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- ▶ Magnitude
 - ▶ Minimal at distance
 - ▶ 10^Δ or greater at near
- ▶ Refractive error
 - ▶ Minimal hyperopia



Non-refractive Accommodative Esotropia Convergence Excess

- ▶ 5% of all cases



Acute Onset Non



Accommodative

- Esotropia ▶ Previously normal binocular vision ▶ Deviation: moderate to large ET ▶ No signs of EOM paresis
- ▶ Diplopia



▶ May cover one eye

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Acute Onset Non-Accommodative Esotropia

- ▶ Acute comitant esotropia in children with brain tumors. Williams AS et al. Arch Ophthalmol 1989;107:376-8 ▶ 6 patients
- ▶ Acute acquired comitant esotropia: a prospective study. Lyons C et al. Eye 1999;13:617-20

- ▶ 10 patients in 40 months
- ▶ Average age 5 (3.5-24)
- ▶ 1/10 cerebellar tumor
- ▶ 9/9 hyperopic
- ▶ 5/9 Rx restored fusion
- ▶ 4/9 surgery
- ▶ Biggest Risk



Exotropia Natural History

- ▶ Worsens?
- ▶ Improves?
- ▶ Stays the same?

▶ The Clinical Course of X(T), Rutstein et al. OVS 2003, 644-49

- ▶ 73 Patients
- ▶ 72% some treatment
- ▶ 49% VT
- ▶ 34% Prism
- ▶ 27% over minus
- ▶ 33% multiple
- ▶ "Intermittent exotropia improved for m quantitatively and qualitatively over time"

Exotropia Characteristics

- ▶ Less common than esotropia
- ▶ In Children: 1 for every 3-5 cases of esotropia ▶ Onset
- ▶ 35-70% within first 2 years of life
- ▶ 85% Intermittent
- ▶ 16-52% associated vertical



Treatment of Esotropia

- ▶ Push Plus
- ▶ Cycloplegic
- ▶ Consider Bifocal
- ▶ BO Prism
- ▶ Vision Therapy
- ▶ Strabismus Surgery



Exotropia Classifications

- Divergence Excess (5-17%)
- Pseudo
- True
- Basic (50%)

- Convergence Insufficiency (33%)
- Older
- Consecutive

- Prospective
- PEDIG 2019
- 15% (overestimate)
- 2/25 motor
- 11/25 stereo
- 12/25 other

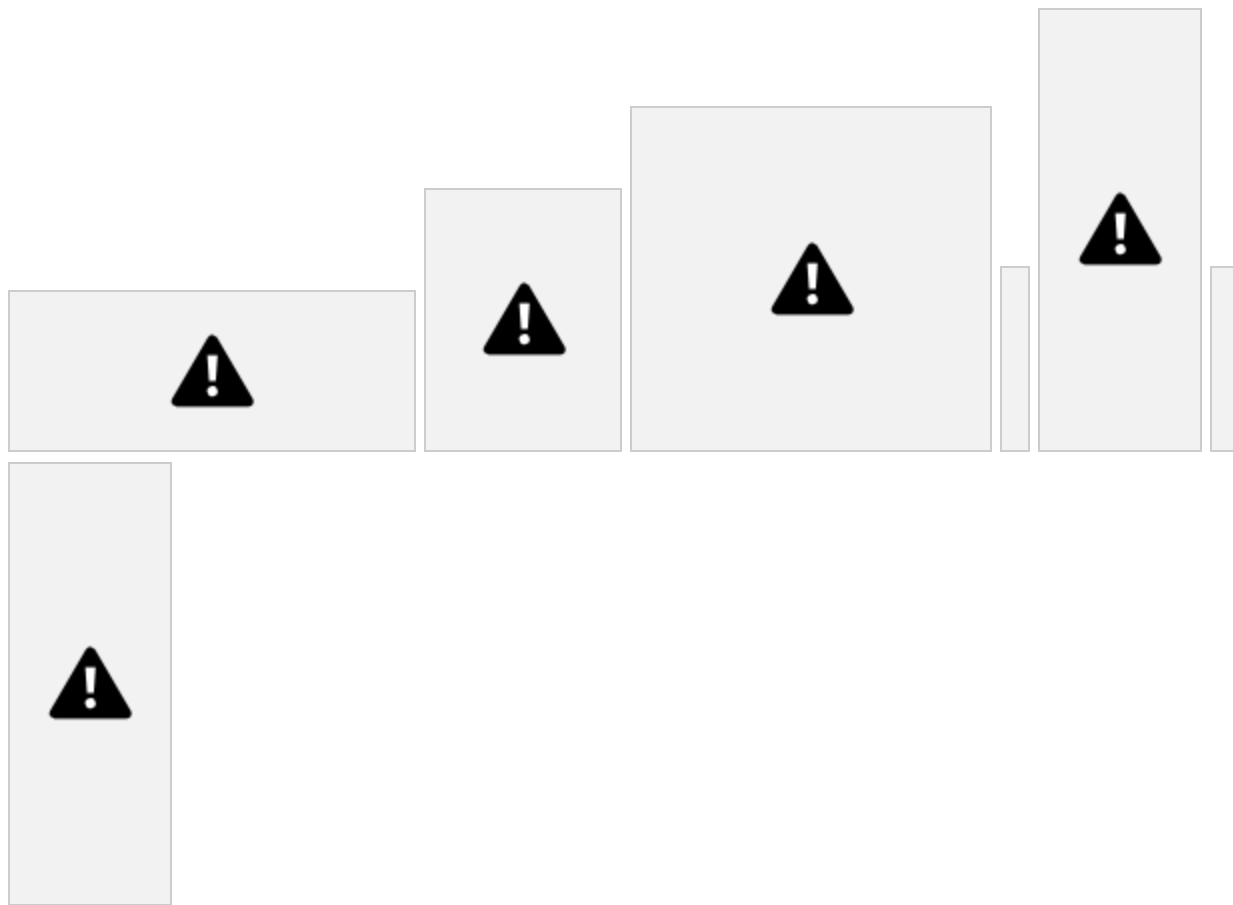
Exotropia Natural History

Exotropia Treatment

- Goals
- Improve stereopsis
- Improve cosmesis
- Observation
 - Vision Therapy
 - Train convergence
 - BI Relieving Prism*
 - To facilitate fusion
 - Alternate Patching

Exotropia Treatment

- Over-minus lenses
- Commonly used by OMDs
- Mechanism: stimulate accommodative convergence?
- Short term: until child old enough for Tx
- Long term: wean off minus if good control
- Amount: 1-4D (over cycloplegia)
- PEDIG Studies
- Surgery
- Magnitude

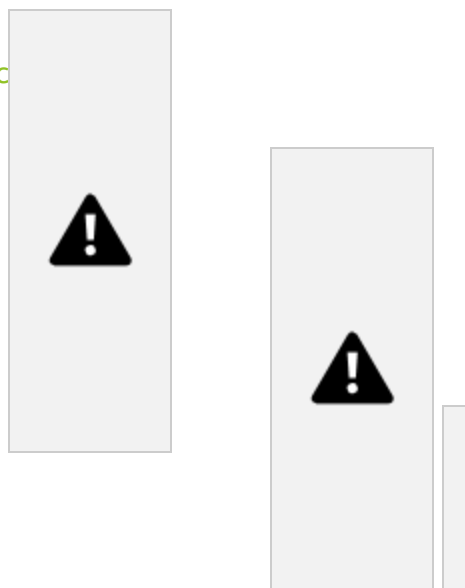


Convergence Insufficiency

- ▶ Triad
- ▶ Receded NPC*
- ▶ $XP' > XP$
- ▶ Reduced positive fusional vergence (Base out)

The Ugly

- ▶ Treatment
- ▶ Vision Therapy
- ▶ BI Prism

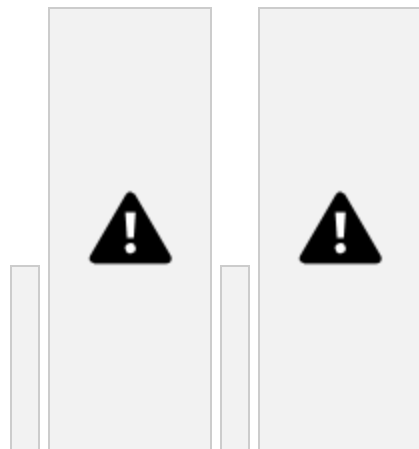
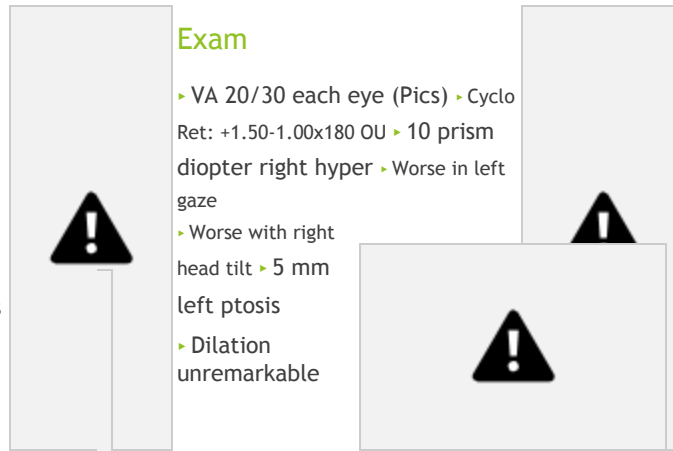


Case 1

- ▶ 3.5 year old Black Male
- ▶ Droopy left eye with head tilt x 10days
- ▶ Mom noted droopy right eye 3 months ago ▶ Evaluation by pediatrician

Exam

- ▶ VA 20/30 each eye (Pics) ▶ Cyclo
- Ret: +1.50-1.00x180 OU ▶ 10 prism diopter right hyper ▶ Worse in left gaze
- ▶ Worse with right head tilt ▶ 5 mm left ptosis
- ▶ Dilation unremarkable



Differentials

- ▶ Congenital CN IV Palsy? ▶ Acquired CN IV Palsy?

- ▶ Parks 3 Step*
- ▶ Vertical Fusion Ranges
- ▶ Increase 10-15 pd
- ▶ Photo Review (FAT Scan)
- ▶ Double Maddox Rod



CN IV Palsy

- ▶ Hyperdeviation greater on contralateral gaze and ipsilateral head tilt
- ▶ Patient will tilt head to contralateral side ▶ Excyclotorsion

CN IV Additional Testing



Parks 3 Step

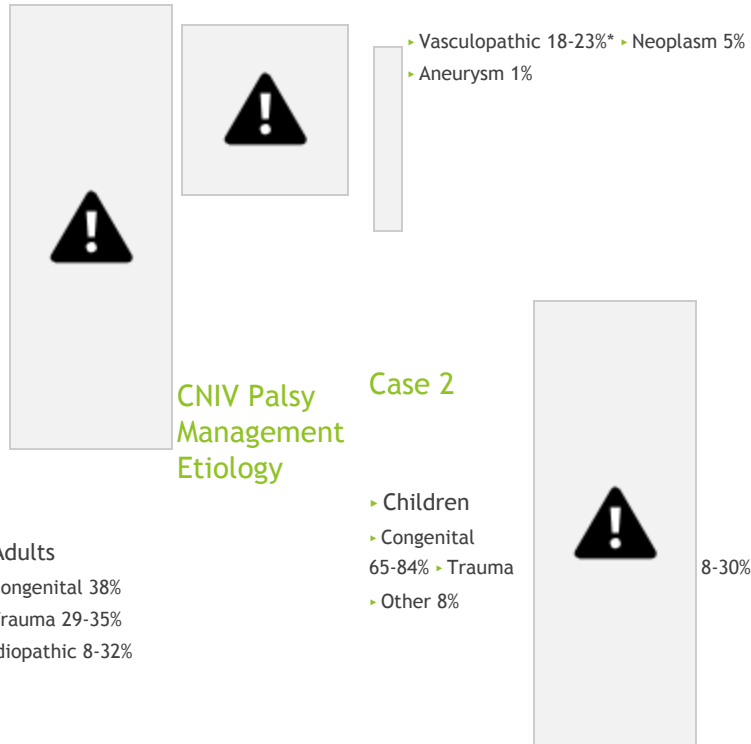
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CNIV Palsy

- Acquired
- With Contralateral **Horner's** = Brainstem
- With Light/near dissociated pupil, loss of vertical saccades, **papilledema** and/or **nystagmus** = Dorsal Midbrain Syndrome
- With Ipsilateral III, V-1, VI and/or Horner's

= Cavernous Sinus Syndrome

- Adults
- Congenital 38%
- Trauma 29-35%
- Idiopathic 8-32%



CNIV Palsy Management Etiology

- Vasculopathic 18-23%* ▸ Neoplasm 5%
- Aneurysm 1%

Case 2

- Children
- Congenital 65-84% ▸ Trauma
- Other 8%

8-30%

Surgical Consult ▶ No P

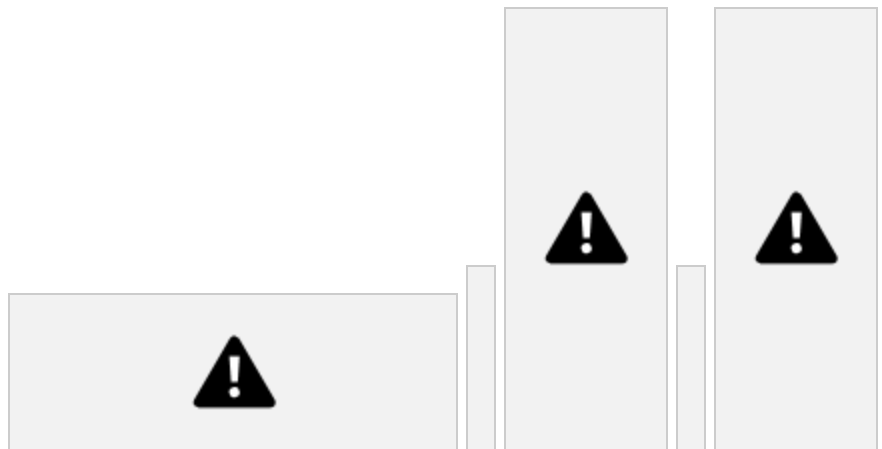
▶ **6 year old male**
headaches x 2
months, vomits
every other day
Complains of
occasional diplopia
and closing one eye
to see better

▶ Exam:
▶ VA 20/20 OD/OS
▶ PERRL (-RAPD)
▶ VF: Full to peripheral

target

▶ Limit of abduction left
▶ Bilateral optic nerve edema

▶ Vertical Prism ▶ < 10 pd



CN VI Palsy

- ▶ Most common EOM palsy
- ▶ Peak age 60-70
- ▶ Abduction deficit
- ▶ Non-comitant ET (Horizontal diplopia) greater distance and ipsilateral gaze

Differentials

▶ Duane's Retraction Syndrome (Type 1)

- ▶ Abduction deficit with globe retraction and narrowing of palpebral aperture on Adduction
- ▶ Spasm of Near Reflex
 - ▶ Bilateral abduction deficit, variable esotropia, myopia
- ▶ Diseases
 - ▶ Grave's, Myasthenia



Duane's Retraction



CN VI Palsy

▶ Brainstem 6th

- ▶ Contralateral hemiplegia
- ▶ Ipsilateral facial palsy
- ▶ Ipsilateral facial analgesia



CN VI Palsy

- ▶ Subarachnoid
 - ▶ Cerebellopontine Angle Tumor
 - ▶ CN V, VII, VIII, Nystagmus, Cerebellar signs
 - ▶ Clivus Lesion
 - ▶ Papilledema
 - ▶ Bilateral CN VI palsy
 - ▶ Petrous Apex - CN VI Palsy, CN V, CN VII
 - ▶ Decreased hearing, Middle Ear infection, Ipsi facial pain, Ipsi facial palsy
 - ▶ Gradenigo's Syndrome
- ▶ Cavernous Sinus
 - ▶ III, IV, V-1
 - ▶ Oculosympthetics



▶ Ipsilateral Horner's

Etiology

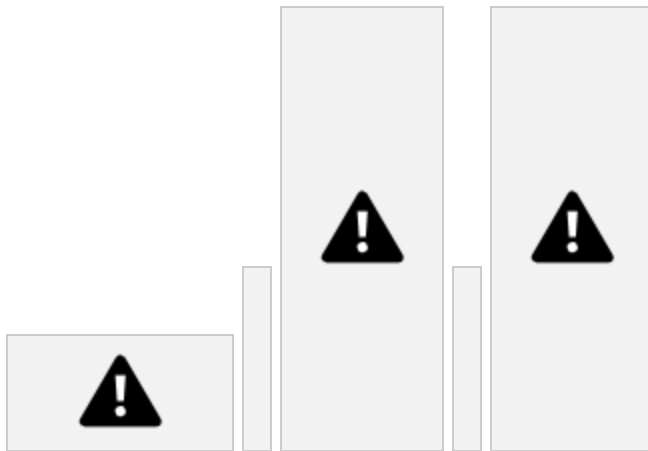
- ▶ Adults
 - ▶ Undetermined 26-30% ▶ Vascular 13-35%
 - ▶ Trauma 12-17%
 - ▶ MS 4-7%
 - ▶ Neoplasm 5
 - ▶ Aneurysm 2
 - ▶ R/O GCA
 - ▶ Children
 - ▶ Neoplasm 19-39%
 - ▶ Trauma 10-34%
 - ▶ Congenital 5-12%
 - ▶ Inflammatory/ Infectious 6-13%



- ▶ Increased ICP 2-23% -IIH %
- ▶ Undetermined 5-15%
- ▶ Consider MRI if no vasculopathic risk factors, young age
- ▶ Monitor
 - ▶ Abduction work
 - ▶ Base out Prism (Fresnel)
 - ▶ Surgical Consult
 - ▶ Timing



Management



Case 3

- 70 W Male presents with 1 day history of double vision
- Vision 20/30 OD, 20/30- OS
- Pupils: OD=OS
- Cover Test: 20 prism diopter RXT
- Right Ptosis (mild)



CN III Palsy

- ▶ Horizontal and Vertical diplopia
 - ▶ Distance and near
- ▶ Ptosis (no diplopia)
- ▶ Dilated fixed pupil
- ▶ Limitation of motilities
 - ▶ Can Abduct



Case 3

- ▶ Medical history
 - ▶ HTN x 25 years - poorly controlled
 - ▶ DM x 10 years - on Metformin
- ▶ Dilation:
 - ▶ Mild NPDR OU
 - ▶ No optic nerve edema or palor
 - ▶ MRI?



Cranial Nerve III

- ▶ Levator
- ▶ Superior Rectus
- ▶ Medial Rectus
- ▶ Inferior Rectus
- ▶ Inferior Oblique
- ▶ Iris Sphincter
 - ▶ parasympathetics

- ▶ Nuclear (Rare)
 - ▶ Often bilateral
- ▶ Fascicular Thirds
 - ▶ Benedict's Syndrome: III with contralateral hyperkinesia (red nucleus)
 - ▶ Weber's Syndrome: III with contralateral hemiparesis (cerebral peduncle)
 - ▶ Nothnagel's Syndrome: III with cerebellar ataxia (brachium conjunctivum)
 - ▶ Claude's Syndrome: III with contralateral hemiparesis and ataxia

CN III Palsies

CN III Palsies

- ▶ Subarachnoid Thirds
- ▶ Fixed Dilated Pupil
- ▶ Aneurysm at junction of posterior communicating and internal carotid arteries
- ▶ Cavernous Sinus/Orbital

Apex

▶ CN III, IV, V-1, VI and /or

Horner's Etiology

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Adults

- ▶ Undetermined 25%
- ▶ Vascular 20%
- ▶ Aneurysm 16-20%
- ▶ Trauma 15%

▶ Neoplasm 12-1

- ▶ Children
- ▶ Congenital 18-47%
- ▶ Trauma 13-53%
- ▶ Neoplasm 2-26%
- ▶ Aneurysm 1-6%
- ▶ Inflammatory/Infectious 3-21%

Management of CN III Palsy

- ▶ Complete Isolated Pupil Spared ▶ > 40 years with vascular disease ok to observe ▶ 40:1 due to vascular disease
- ▶ Incomplete Isolated Pupil Spared ▶ Pupil Fibers travel inferior
- ▶ 30-40% aneurysm



- ▶ Pupil Involved/Complicated
- ▶ STAT to ER
- ▶ Double Vision
- ▶ Prism H&V

Take Home Message...

- ▶ Look at the company it keeps. ▶ If in doubt, refer out.
- ▶ References

