Adult Diplopia Grand Rounds

Jacqueline Theis, OD, FAAO, FNAP

Concussion Care Centre of Virginia, Ltd. | Virginia Neuro-Optometry | Intrepid

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Financial Disclosures - Dr. Theis

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Oculus - Speakers Board
MedEvolve - Speakers Board
Tarsus – Speakers Board
PER – Speakers Board
Abbvie – Advisory Panel
Alcon – Speakers Board, Advisory panel
Dompe – Speakers Board
Zeiss – Advisory panel

All risks have been mitigated

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Why does diplopia scare us?

- Etiology/Vast Differential Diagnosis
  - Benign vs. Life Threatening
  - Rare vs. Common
- Time for a full workup
  - It's not a 20 minute complaint!
- Multidisciplinary
  - Eyes
  - Brain
  - Systemic

Rucker J, Kennard C, Leigh J. The neuro-ophthalmological examination. *Handbook of clinical Neurology*. 2011: 102:71-94
Karmel M, Eggenberger E. Deciphering Diplopia. Eye Net. Nov/Dec 2009. PP31-34

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Introduction – Questions to ask yourself

- What do you do when an adult patient sits in your chair for a "routine" eye examination and complains of diplopia?
- Where do you start your examination?
- What additional testing do you need to add to your examination?
- When is further labwork and neuroimaging indicated?

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Objectives

- Give a brief overview of the importance of clinical history taking in diplopia and how it may guide your decision to order ancillary testing
- Outline the ancillary testing that may be required in adult diplopia evaluations
- Review diagnosis and management of adult diplopia using cases including exophoria, esophoria, vertical phoria, and cranial nerve palsies
- Elaborate on some general pearls for prescribing prism

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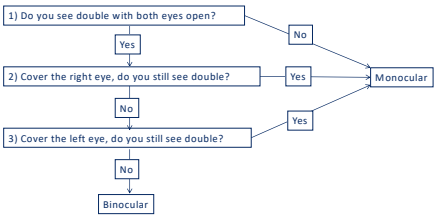
Monocular vs. Binocular Diplopia



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Monocular vs. Binocular

Monocular

- Refractive
- Ocular Media
  - Tear film – Dry eye
  - Cornea – irregular, keratoconus, LASIK, scars
  - Iris – LPI, damage
  - Lens – cataract, IOL decentration
  - Retina – ERM, CNVM, macular disease
- Cerebral cortical dysfunction

Binocular

- Orbital Disorder
  - Orbital Disease/Displacement (TTTI) – Trauma, Tumor, Thyroid, Infection
  - EOM Restriction – Thyroid, Tumor, EOM entrapment, EOM iatrogenic injury
  - EOM Weakness – Myopathy/Dystrophy
- Neurological Disorder
  - Neuromuscular Junction Dysfunction – MG, botulism
  - CN Palsy – III, IV, VI
  - Brain stem injury

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Examination

Monocular Diplopia

- Visual acuity
- Refraction
- Ocular Health
  - Anterior segment
  - Posterior segment

Binocular Diplopia

- Afferent visual pathway
  - Visual acuity (BCVA/Pinhole), color vision, visual fields, pupils
  - *Ocular Health*
- Efferent visual pathway
  - Cover test(s)
  - Ocular Motility

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Rote Approach to Diplopia Chief Complaint

- Monocular or binocular diplopia?
- Horizontal, vertical, or diagonal?
- Gaze Dependent? Left vs right? Up vs down? Distance vs near?
- Onset - When did it start?
- Duration - How long does it last? (intermittent, constant)? How often does it happen?
- Frequency – is it getting better, worse, or staying the same since it started?
- Timing
  - When does it occur?
  - What are you doing when it occur(ed)s?
  - Worse at the beginning or end of the day?
- What makes it better?
- What makes it worse?
- Has this ever happened to you before?

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Rote Approach to HPI/ROS related to Diplopia "Weed out the Weird"

- New vision changes?
  - Blur?
  - Loss of vision?
  - Dimming of vision?
  - Visual field changes?
- Pain?
  - Eye Pain?
  - Headaches?
- Tingling in the limbs, fingers or toes?
- Numbness or weakness in the face, arms or legs?
- Nausea or vomiting?
- Changes in balance or vertigo?
- Photophobia?
- Hearing Loss?
- Giant Cell Arteritis symptoms (jaw claudication, neck stiffness, temporal artery or forehead pain)?

Family History: Eye turn, systemic disease

- Recent weight loss or weight gain that was unintentional?
- Recent fever?
- History of head trauma or motor vehicle accidents?
- History of systemic disease?
  - Hypertension
  - Diabetes
  - High Cholesterol
  - Heart disease
  - Cancer
  - Thyroid disease
- History of recent travel?
- Medications
  - Any new medications?
  - Recently stopped taking medications?
  - Are you taking medications as they were prescribed for you?

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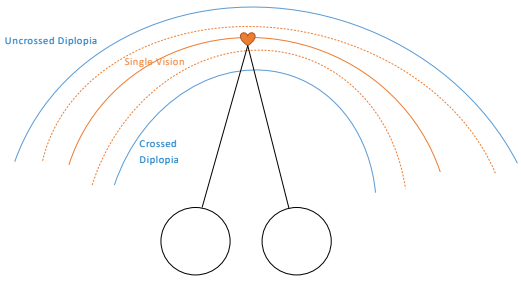
Panum's fusional Area



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What does the brain need to combine two images from two eyeballs into one perceived image??

- Location – Projected Images need to be located in relatively the same place in space, in ALL gazes
  - Ocular Posture – strabismus, cranial nerve palsies, etc
- Images need to be of similar clarity
  - Visual Acuity
- Images need to be of similar size
  - Aniseikonia
- Images need to be of similar shape
  - Metamorphopsia

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Examination: Binocular Diplopia

To Understand the Diplopia

- Distance Visual Acuity
  - Entering acuity
  - Pinhole Acuity
- Cover Test/Ocular Posture
- Vergence Ranges
- Other ocular motility testing
  - Fixation
  - Versions
  - Ductions
  - Saccades
  - Pursuits

Ancillary Testing

- Color Vision
  - Ishihara, AOHRR, Red Cap
- Pupils
  - Size in light/dark
  - Reaction to light/dark
  - Near response
  - RAPD?
- Visual Fields
  - Confrontation
  - Amsler
  - Automated - FDT/HVF
- Ocular Health – Slit Lamp (with Fluorescein dye) and fundus examination (PHOTO)
- Eyelids (MRD1/MRD2), Levator function
- Orbits (Exophthalmometry, symmetry)
- Optic Nerve Evaluation
- Fundus Evaluation
- Cranial Nerve Evaluation I-XII

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How To Prescribe Prism

What the Text Book Says

- Exos
  - Sheard's Criterion
    - 2/3 phoria – 1/3 Break at near
- Esos –
  - Basic/Convergence Excess type - Percivals
    - 1/3G-2/3L
      - G = greater of the two lateral limits (BI/BO)
      - L = lesser of the two lateral limits (BI/BO)
      - If P =0 or negative, prism is not indicated
  - Divergence insufficiency type – Saladin 1:1 rule
    - Prism = (Phoria-BI recovery)/2

What Clinical Wisdom Says

- Exos
  - 1/3 of the deviation
- Esos
  - All of it at distance
- Vertical
  - All of it at distance

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How to prescribe prism

What Dr Theis Says…

- Use multiple measuring methods to prescribe
  - Cover Test – know your maximum
    - Perform in gaze of complaint
    - Prescribe based on complaint
  - Vergences should be balanced/normalized
  - Clinical/Textbook wisdom
- Prescribe for the "gaze of complaint"
- Caloroso's residual vergence demand
  - Esos 6-20pd, RVDC 4-6pd
  - Exos 20-30pd, RVDC 10-15pd
  - Hyperdev 3-10pd, RVDC 2-4pd
- If you are unsure, prescribe a Fresnel and follow up

Fusional vergence ranges – Prism Bars are your new best friend

- Video – Cover Test(s)
- Video - Vergences

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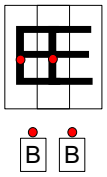
Cover Test - Size Matters



Distance Cover Test Target

- Isolated Supra-threshold Target (2-3 lines above Threshold)

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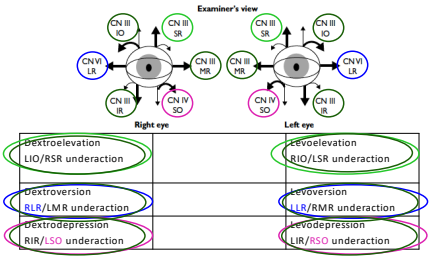
Comitancy Quick Review



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Case: Tracy - 47yo female, Vertical Diplopia in Right Gaze

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When to Image a CN Palsy?

- Multiple CN Palsies
- Age <50yo
- No vasculopathic risk factors
- Absence of improvement in 3months for isolated palsy.
- Its atypical

Murchison AP et al. Neuroimaging and Acute Ocular Motor Mononeuropathies. *Arch Ophthalmol*. 2011. 129(3):301-305

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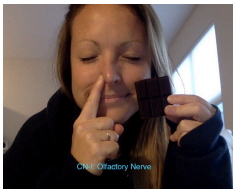
Other Cranial Nerve Testing

- CN1 – Olfactory Nerve
- CN2 – Optic Nerve
- CN3 – Oculomotor Nerve
- CN4 – Trochlear
- CN5 – Trigeminal
- CN6 – Abducens
- CN7 – Facial Nerve
- CN8 – Acoustic Nerve
- CN9 – Glossopharyngeal Nerve
- CN10 – Vagus Nerve
- CN11 – Accessory Nerve
- CN12 – Hypoglossal Nerve



Casser L, Fingeret M, Woodcome HT. *Atlas of Primary Eyecare Procedures*. McGraw-Hill. 2nd ed.

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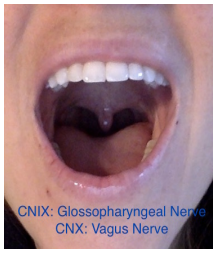

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Case 1 – 45year old, Caucasian female

- Chief Complaint: I have double vision
  - Horizontal
  - Intermittent – only occurs at night ~5-6pm
  - At near only, when reading or on phone/computer
  - Started about 1 year ago, but was diagnosed with an eye turn at 10 years old
  - (-) HPI/ROS
  - Uses +1.00 readers, doesn't help
- Differential Diagnosis
  - Decompensated esophoria/exophoria
  - Myasthenia gravis

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What is a "Decompensating" Phoria?

- Phoria – Relative misalignment of eyes when binocular fusion is disrupted
  - Alternating Cover Test
- Tropia – Strabismus, manifest misalignment of eyes relative to one another
  - Unilateral Cover Test
- "Decompensating" – what you use to compensate for your ocular posture) (ie vergences) is not working!
  - Frequency of deviation increases
  - Magnitude stays the same!
  - **Diagnosis of Exclusion!**

Pelak V. Evaluation of Diplopia: An Anatomic and Systemic Approach. *Hospital Physician*. Mar 2004:17-25

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Case 1 – 45year old, Caucasian female

- Pertinent Exam Findings
  - Refraction
    - OD: Plano 20/20
    - OS: +0.25 20/20
    - Add: +1.00
  - Ocular Health: Normal OU, TBUT 10 sec OU
  - Cover Test:
    - Distance: 14XP
    - Near: 25X(T) - 20% frequency
  - Fusional Vergences (measured sRx at Distance, c+1.00 at Near)
    - BI Distance: x/8/6 BI Near: x/25/20
    - BO Distance: x/16/14 BO Near: x/25/20 (Normal x/16/14)
  - Near Point of Convergence: 10cm, 12cm, 14cm

Questions to ask yourself:
1) Why is the patient having symptoms?
2) Is this new or longstanding?

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How did I get 25X(T) with 20% frequency at near?

- Intermittent XT at near frequency video
  - Emphasize unilateral CT vs alternating CT

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Case 1 – 45year old, Caucasian female

- Pertinent Exam Findings
  - Refraction
    - OD: Plano 20/20
    - OS: +0.25 20/20
    - Add: +1.00
  - Ocular Health: Normal OU, TBUT 10 sec OU
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  - Fusional Vergences (measured sRx at Distance, c+1.00 at Near)
    - BI Distance: x/8/6 BI Near: x/25/20
    - BO Distance: x/16/14 BO Near: x/25/20 (Normal x/16/14)
  - Near Point of Convergence: 10cm, 12cm, 14cm
- Diagnosis: Intermittent Exotropia – Convergence insufficiency type
  - Likely decompensation from fatigue

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Why am I not *that* worried in this case?

Duane White Classification

ESOTROPIA	
Basic	DCT=NCT
Convergence Excess	NCT>DCT
Divergence Insufficiency	DCT>NCT
EXOTROPIA	
Basic	DCT=NCT
Convergence Insufficiency	NCT>DCT
Divergence Excess	DCT>NCT

Duane A. A new classification of the motor anomalies of the eye, based upon physiologic principles. *Ann Ophthalmol Otol*. Part I. 1897. Part II Jan.

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What else could cause X(T)-CI?

- Traumatic brain injury
- Parkinson's disease
- Myasthenia Gravis
- Lyme Disease
- Multiple sclerosis or other demyelinating disease
- Pseudotumor cerebri
- Behavioral medications
- Oculomotor restriction/palsy
  - CN III
  - Duane's syndrome
  - Thyroid eye disease

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Case 1 – 45year old, Caucasian female

What are you going to prescribe?
- Nothing
- Sheard's Criterion: 2/3(25) – 1/3(16)
  - 16.67-5.33 = 11.34pd
- Clinical Wisdom: 1/3(25) = 8pd

- Cover Test:
  - Distance: 14XP
  - Near: 25XP
- Fusional Vergences (measured sRx at Distance, c+1.00 at Near)
  - BI Distance: x/8/6 BI Near: x/16/14
  - BO Distance: x/16/14 BO Near: x/25/20 (Normal x/16/14)
- Near Point of Convergence: 10cm, 12cm, 14cm
- Prism Demonstration
  - 4-6pd, patient appreciates 4pd
- Prescribed: 4pd BI Fresnel over non-dominant eye
  - Return in 4 weeks

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Case 1 – 45year old, Caucasian female

- Why Follow up?
  - Rule out myasthenia gravis
  - Discuss lens options
    - Progressive or SV reading
- Cover Test: *Stable to last exam*
  - Distance: 14XP
  - Near: 25XP
- Fusional Vergences (measured sRx at Distance, c+1.00 at Near and 4BI Fresnel)
  - BI Distance: x/8/6 BI Near: x/14/10
  - BO Distance: x/16/14 BO Near: x/35/30 (Normal x/16/14)
- Near Point of Convergence: 6, 8, 10cm
- Prism Demonstration
  - 4-6pd, patient appreciates 4pd
- Prescribed: BI split prism readers
  - OD: +1.00 2.0BI
  - OS: +1.25 2.0BI

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Case 1 Learning Pearls

- Know your normal vs "abnormal" Duane White classifications
- Use your case history to guide the need to rule out secondary causes of convergence insufficiency
- Prism can be an "evening" thing
- Use Fresnel prism trial if you are uncertain about what to prescribe, or if the patient's diplopia complaints occur outside of office hours

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Case 2 – 55year old, Asian Female

- Chief Complaint: Eyestrain with glasses – optical department sent me to you because I have had 5 redo's and they said you are really good at refractions
  - Eyestrain when "I put them on"
  - Worse when I try to read something or look at my phone
- Wearing Progressives:
  - OD: +1.00-0.50x180 20/20
  - OS: +1.50-0.75x005 20/20
  - Add: +1.75 20/20
  - Pupil distance measured in lenses: 61
  - Patient pupil distance: 61
  - Add measured at bottom of lenses: +1.75

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Case 2 – 55year old, Asian Female

- Cover Test:
  - Distance: 1.5RHyperphoria (primary gaze)
    - Primary gaze = right tilt = left tilt
      - (-) Bielchowsky head tilt test = unlikely CNIV palsy
  - Near: 1.5RHyperphoria (primary gaze)
    - Primary gaze = down gaze = right gaze (comitant in all nine fields of gaze)
      - Unlikely CNIII palsy (also pupils and eyelids are normal)
- Diagnosis: Vertical Phoria

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How do you do the Bielchowsky Head Tilt Test?

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Is this the same as the Maddox Rod Test?

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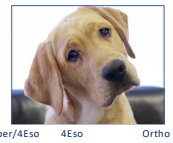
Comitancy

- Comitant Strabismus – nonparalytic, deviation remains similar in different gazes and relative to each eye
- Clinical Tests of Comitancy
  - Primary vs. Secondary Angle
  - CT in 9 Fields of Gaze
- Incomitant Strabismus
  - Difference in deviation >5pd
  - Anomalous head posture is not a clinical diagnostic test of comitancy



4LHyper/4Eso	4Eso	Ortho
5LHyper/6Eso	5LHyper/4Eso	3Eso
8LHyper/8Eso	5LHyper/6Eso	6Eso

Ortho 10LHyper

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  - Near: 1.5RHyperphoria (primary gaze)
    - Primary gaze = down gaze = right gaze (comitant in all nine fields of gaze)
      - Unlikely CNIII palsy (also pupils and eyelids are normal)
- Diagnosis: Vertical Phoria
- What are you going to prescribe?
  - 0.5BD OD
  - 1.0BD OD
  - 1.5BD OD
  - 2.0BD OD
  - What about BU OS?

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Vertical Vergence Ranges using a Prism Bar

- Expanded vs. not expanded
- Norms: x/3/2
- Not Norms: >5

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Case 2 – 55year old, Asian Female

- Cover Test:
  - Distance: 1.5RHyperphoria (primary gaze)
  - Near: 1.5RHyperphoria (primary gaze)
- Vertical Vergences performed over OD (primary gaze distance, downgaze near)
  - Distance BU: 1/0
  - Distance BD: 4/3
  - Near BU: 1/-1
  - Near BD: 2/1

Clinical Wisdom: 1.5

- Diagnosis: Vertical Phoria
- Prescribed: compensating prism
  - OD: +1.00-0.50x180 0.75BD
  - OS: +1.50-0.75x005
  - Add: +1.75

If Prescribe 0.5BD OD
- Distance BU: 1.5/0.5
- Distance BD: 3.5/2.5
- Near BU: 1.5/-0.5
- Near BD: 1.5/0.5

If Prescribe 1.0BD OD
- Distance BU: 2/1
- Distance BD: 3/2
- Near BU: 2/0
- Near BD: 1/1

If Prescribe 1.5BD OD
- Distance BU: 2.5/1.5
- Distance BD: 2.5/1.5
- Near BU: 2.5/1.5
- Near BD: 0.5/-0.5

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Prescribing Vertical Prism Pearls

- If prescribing <2.0pd, put it all in one eye to ensure it is ground in
- If prescribing ground-in prism in one eye only, prescribe it in the BD eye
  - Base down prism has less optical reflections from overhead lighting
- If prescribing Fresnel prism – always prescribe the BD prism unless drastic difference in visual acuity because the reflections from lights will drive them nuts

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When is a vertical deviation ominous?

- Developmental vertical phoria = 0-3pd (usually 1-2pd)
- Longstanding deviations will usually have expanded vertical vergences (but not always)
- They will be incomitant (bigger in one field of gaze)
- Differential Diagnosis of vertical misalignment
  - Myasthenia Gravis
  - Thyroid eye disease
  - CN IV palsy
  - CN III palsy
  - Skew Deviation
    - MS (younger patient)
    - Stroke (older patient)
  - Orbital Mass

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Case 3 – 60year old, Hispanic Male

- Chief complaint: I have double vision
  - Diagonal
  - Constant x 3-4 weeks –started at 10:00am on a Tuesday
  - Has been getting worse since onset
  - Having difficulties walking down stairs, driving, looking to the left
- Pertinent Medical History
  - Diabetes Type 2, Hypertension, High Cholesterol
  - Taking corresponding medications for aforementioned diseases

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Case 3 – 60year old, Hispanic Male

- Entering Acuity: 20/20 OU, Ocular Health Normal
- Cover Test: (primary gaze)
  - Distance: 5LHyper, 2Esophoria
    - Right Tilt: 2LHyper
    - Left Tilt: 8LHyper, 4EP
  - Near: 5LHyper, 4exophoria
- Cover Test: Nine Fields of Gaze

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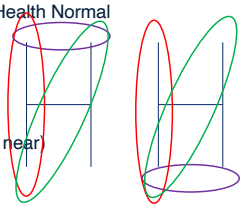
Case 3 – 60year old, Hispanic Male

- Entering Acuity: 20/20 OU, Ocular Health Normal
- Cover Test: (primary gaze)
  - Distance: 5LHyper, 2Esophoria
    - Right Tilt: 2LHyper
    - Left Tilt: 8LHyper, 4EP
  - Near: 5LHyper, 4exophoria
- Cover Test: Nine Fields of Gaze (at near)



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Case 3 – 60year old, Hispanic Male

- Pertinent Medical History
  - Diabetes Type 2, Hypertension, High Cholesterol
  - Taking corresponding medications for aforementioned diseases
- Diagnosis: Left CNIV Palsy
  - Differential: Most likely ischemic
    - Thyroid: (-) proptosis, dry eye, eyelid retraction, muscle restriction
    - Myasthenia gravis: (-) fatigue/intermittent complaints, (-) ptosis
    - Multiple Sclerosis: (-) numbness/tingling or other neurological signs/symptoms
    - Infectious/Inflammatory/mass: (-) other neurological signs/symptoms
    - Giant Cell Arteritis: (-) GCA symptoms, (+) >55 years old (-) demographics
  - Workup
    - Check blood pressure in-office: 140/90
    - Note to PCP to update labs: Fasting glucose, fasting cholesterol, HbA1c, TSH, myasthenia panel, Creatinine with GFR, CBC with differential, ESR, CRP
      - *If worried about infection: Lyme titer, HIV, syphilis, HSV/VZV, etc*

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When to Image a CN Palsy?

- Multiple CN Palsies
- Age <50yo
- No vasculopathic risk factors
- Absence of improvement in 3months for isolated palsy.
- Its atypical
- History of cancer

Murchison AP et al. Neuroimaging and Acute Ocular Motor Mononeuropathies. *Arch Ophthalmol*. 2011. 129(3):301-305

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Case 3 – 60year old, Hispanic Male

- Cover Test: (primary gaze)
  - Distance: 5LHyper, 2Esophoria
    - Right Tilt: 2LHyper
    - Left Tilt: 8LHyper, 4EP
  - Near: 5LHyper, 4exophoria
- Vertical Vergences (over OD at distance over 5BD OS)
  - BD 2/1
  - BU 2/1
- Cover Test: Nine Fields of Gaze (at near)

What are you going to prescribe?
- Nothing
- Patch
- 5BD OS
- 7BD OS
- 10BD OS

4LHyper 2XP	2LHyper 6XP	6XP
7LHyper 2EP	5LHyper 4XP	3LHyper 4XP
12LHyper 2EP	10LHyper	6LHyper 2XP

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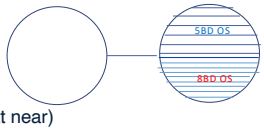
Case 3 – 60year old, Hispanic Male

- Cover Test: (primary gaze)
  - Distance: 5LHyper, 2Esophoria
    - Right Tilt: 2LHyper
    - Left Tilt: 8LHyper, 4EP
  - Near: 5LHyper, 4exophoria
- Cover Test: Nine Fields of Gaze (at near)



4LHyper 2XP	2LHyper 6XP	6XP
7LHyper 2EP	5LHyper 4XP	3LHyper 4XP
12LHyper 2EP	10LHyper	6LHyper 2XP

Prescribed:
5BD OS Fresnel Distance Segment
8BD OS Fresnel Near Segment

Follow up: 4-6 weeks

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Case 3 – 60year old, Hispanic Male

- Follow Up 4-6 weeks later
- Cover Test: (primary gaze)
  - Distance: ortho
  - Near: 4exophoria
- Cover Test: Nine Fields of Gaze (at near)

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Case 3 Pearls

- Use Fresnel Prisms in ischemic CN palsies
  - Reduce fall risk from diplopia/patching
- Check ischemic CN palsies monthly for resolution and to confirm diagnosis
  - If no resolution within 3 months of onset – need to neuro-image
- Segment Fresnel prism can be a game changer

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Case 4 – 80year old, Caucasian Male

- Chief complaint: Intermittent vertical double vision x 6 months
  - Vertical, binocular
  - Started 6 months ago intermittently 1-2x/week, gradually getting worse/more frequent
  - Currently occurs every day intermittently for a few seconds 0-60 when he is reading or going down the stairs (has to tilt his head down to walk down the stairs)
    - Reading: newspaper, or ticker on the News
    - Denies right/left gaze diplopia
  - Vision isn't as crisp as it used to be, but feels he sees just fine
  - (-) ROS/HPI
- Pertinent Medical History
  - Hypertension, High Cholesterol – well medically controlled with atorvastatin and compliant with meds. Denies any changes to his medications
- Last Eye Exam: 1 year ago
  - BCVA 20/25 OU
  - 1+ NS cataracts

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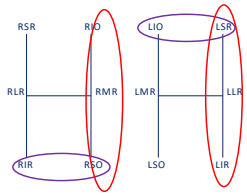
Case 4 – 80year old, Caucasian Male

- Best Corrected Visual Acuity
  - OD: +1.00-0.50x175 20/30 PAP 20/20
  - OS: +1.50-0.75x005 20/30- PAP 20/20
- Cover Test: (primary gaze)
  - Distance: 15RHyper
    - Right Tilt: 15RHyper
    - Left Tilt: 15RHyper
  - Near: 15RHyper, 4exophoria
- Vertical Vergences (over OD at distance)
  - BD 20/18
  - BU 5/4
- Cover Test: Nine Fields of Gaze (at near)

10RHyper 6XP	10RHyper 6XP	10RHyper 6XP
15RHyper 4XP	15RHyper 4XP	15RHyper 4XP
15RRHyper	20RHyper	20RHyper

Diagnosis: Right CNIV Palsy – likely longstanding, likely decompensating from cataracts



Bielchowsky/Parks 3 step: Inconclusive

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Case 4 – 80year old, Caucasian Male

- Cover Test: (primary gaze)
  - Distance: 15RHyper
    - Right Tilt: 15RHyper
    - Left Tilt: 15RHyper
  - Near: 15RHyper, 4exophoria
- Vertical Vergences (over OD at distance)
  - BD 20/18
  - BU 5/4
- Cover Test: Nine Fields of Gaze (at near)

What are you going to prescribe?
- Nothing
- Patch
- 5BD OD
- 10BD OD
- 15BD OD

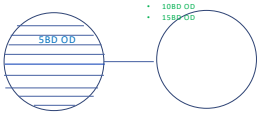
10RHyper 6XP	10RHyper 6XP	10RHyper 6XP
15RHyper 4XP	15RHyper 4XP	15RHyper 4XP
15RRHyper	20RHyper	20RHyper

60

Case 4 – 80year old, Caucasian Male

- Cover Test: (primary gaze)
  - Distance: 15RHyper
    - Right Tilt: 15RHyper
    - Left Tilt: 15RHyper
  - Near: 15RHyper, 4exophoria
- Vertical Vergences (over OD at distance)
  - BD 20/18
  - BU 5/4
- Cover Test: Nine Fields of Gaze (at near)

What are you going to prescribe?
- Nothing
- Patch
- 5BD OD
- 10BD OD
- 15BD OD



10RHyper 6XP	10RHyper 6XP	10RHyper 6XP
15RHyper 4XP	15RHyper 4XP	15RHyper 4XP
15RRHyper	20RHyper	20RHyper

Prescribed:
5BD OD Full segment
*If you don't like it take it off

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Congenital ocular motor cranial nerve palsy

- Congenital CN III
  - Often noted soon after birth due to obvious nature/presentation
- Congenital CN VI
  - Not always noted until child begins to track, has anomalous head posture - turn
  - Rare without concomitant Duane syndrome or Mobius Syndrome
- Congenital CN IV
  - Not always noted until child begins to track, has anomalous head posture – tilt
  - Relatively common

Pineles SL, Velez FG. Isolated Ocular Motor Nerve Palsies. *J Binocul Vis and Ocular Motil*. 2018:68(3):70-77

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Review of Isolated CN Palsy in Adults

Cranial Nerve	Oculomotor (III)	Trochlear (IV)	Abducens (VI)
Etiology	Microvascular ischemia Stroke Aneurysm Traumatic *Demyelination, trauma, tumors, increased intracranial pressure*	Congenital Trauma Microvascular ischemia Stroke *Demyelination, trauma, tumors, increased intracranial pressure*	Neoplasm Trauma Microvascular ischemia Stroke *Demyelination, trauma, tumors, increased intracranial pressure*
Suggested workup	Rule out undiagnosed vascular risk factors MRI brain+orbits with contrast MRA or CTA of brain If imaging normal, consider lumbar puncture Rule out MG/thyroid/GCA	Rule out undiagnosed vascular risk factors* MRI brain+orbits with contrast Lumbar puncture if sx of meningitis Rule out MG/thyroid/GCA	Rule out undiagnosed vascular risk factors MRI brain+orbits with contrast Lumbar puncture if sx of meningitis Lab: syphilis, lyme Rule out MG/thyroid/GCA

*if elderly and + vascular risk factors, it is reasonable to observe for resolution

Pineles SL, Velez FG. Isolated Ocular Motor Nerve Palsies. *J Binocul Vis and Ocular Motil.* 2018:68(3):70-77

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Should we neuro-image and/or further workup?

- What we know
  - Vasculopath – hypertension and high cholesterol
  - Onset 6 months ago, more frequent/worsening
  - Isolated CN IV Palsy
    - All other CN I – XII are intact
    - Normal afferent visual pathway (red cap, visual fields, PAP visual acuity, ocular health – aside from cataracts)
    - Expanded vertical vergences
    - No head tilt
    - Intermittent diplopia with prolonged gaze/task/lighting specific
- Plan
  - Consulted PCP, ran labs/minimize vasculopathic risk factors, ruled out mimickers (GCA, thyroid, MG)

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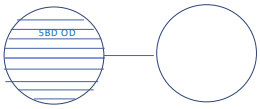
Case 4 – 80year old, Caucasian Male

- **4 week follow up:** Patient is happy with prism, no episodes of diplopia
- Visual Acuity: stable 20/30 OU
- Cover Test: (primary gaze) with 5 BD OD Fresnel glasses
  - Distance: 10RHyper
    - Right Tilt: 10RHyper
    - Left Tilt: 10RHyper
  - Near: 10RHyper, 4exophoria
- Vertical Vergences (over OD at distance)
  - BD 20/18
  - BU 10/4
- Cover Test: Nine Fields of Gaze (at near): STABLE to previous



Prescribed:
5BD OD Full segment
*If you don't like it take it off

65

Case 4 – 80year old, Caucasian Male

- **6 month follow up:** prism isn't working, having trouble seeing especially at night or in bright light
- Visual Acuity: worse 20/50 OU BCVA, 20/80 glare acuity, PAP 20/20
- Cover Test: (primary gaze) with 5BD OD Fresnel glasses
  - Distance: 10RHyper
    - Right Tilt: 10RHyper
    - Left Tilt: 10RHyper
  - Near: 10RHyper, 4exophoria
- Vertical Vergences (over OD): Unable to fuse with any prism
- Cover Test: Nine Fields of Gaze (at near): STABLE to PREVIOUS
- What has changed??
  - Cataracts! Vision!
    - Remember: To see single you need the images
      - In the same location
      - The same shape/size
      - The same clarity
- Plan: Refer for cataract surgery

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Case 4 – 80year old, Caucasian Male

- **Post OP follow up:** Patient is happy with vision, still gets occasional double vision if reading for prolonged periods of time >2 hours
- Visual Acuity: 20/20 sRx OD/OS
- Ocular Health: PCIOL OU
- Cover Test: (primary gaze) STABLE to previous
  - Distance: 15RHyper (primary = right tilt = left tilt)
  - Near: 15RHyper, 4exophoria
- Vertical Vergences (over OD at distance)
  - BD 20/18
  - BU 8/4 (Better than at his initial 4 week follow up WITHOUT compensating prism!)
- Cover Test: Nine Fields of Gaze (at near): STABLE to previous

10RHyper 6XP	10RHyper 6XP	10RHyper 6XP
15RHyper 4XP	15RHyper 4XP	15RHyper 4XP
15RRHyper	20RHyper	20RHyper

Prescribed: 3BD OD Fresnel Segment

*Called patient in 2-4 weeks, he loved it so prescribed ground in prism readers:

OD: +2.50 1.5BD
OS: +2.50 1.5BU

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Case 4 – 80year old, Caucasian Male

- **1 Year follow up:** Patient is happy, except gets intermittent blurry and double vision even with prism readers after 10-15 minutes of prolonged reading and/or watching television, at night only (okay during the day)
- Visual Acuity: 20/20- sRx OD/OS
- Ocular Health: PCIOL OU, TBUT 0-2 sec, 2+ scurf
- Cover Test: (primary gaze) STABLE to previous
  - Distance: 15RHyper (primary = right tilt = left tilt)
  - Near: 15RHyper, 4exophoria
- Vertical Vergences (over OD at distance)) STABLE to previous
- Cover Test: Nine Fields of Gaze (at near): STABLE to previous
- What has changed?
  - Dry Eye! Visual Clarity
  - Plan: Warm compresses/lid scrubs BID, artificial tears QID. Recheck in 4-6 weeks

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Case 4 Pearls

- Know how to differentiate between acquired vs. congenital CN palsy
  - HPI/ROS, previous pictures
  - When/if in doubt, neuro-image
- Use vertical vergences to confirm suspicions of acquired vs. congenital CN palsy as well as aid in prescribing prism
  - You may not need full vertical prism to correct congenital CN palsies
- Congenital CN palsies may decompensate in adults as they acquire changes to their visual clarity (cataracts, dry eye)
- You don't always have to fix double vision with prism glasses, you need to fix what is causing the double vision (which is sometimes cataracts and dry eye!)

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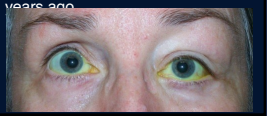
Case 5 – 65 year old, Caucasian Female

- Chief Complaint: Intermittent diagonal double vision at distance more than near
  - Started 2 years ago
  - Occurs more towards the end of the day
  - Goes away after reading for 30 minutes, but see it mostly at distance now
- Pertinent ocular history:
  - Mild left upper eyelid ptosis diagnosed 5 years ago
    - Presumed to be due to RGP overwear



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Case 5 – 65 year old, Caucasian Female

- OS Ptosis – Pertinent Exam History
- 5 years ago
  - Ortho in primary gaze
  - Mild Giant papillary conjunctivitis
  - Hertel Base 92, 14mm OD, 16mm OS
  - PAS: 10mm OD, 8mm OS
- 2 years ago
  - PAS 11mm OD, 9mm OS
- Vertical Diplopia – Pertinent Exam History
  - 2 years ago
    - Cover test: Ortho
    - Accepts 1.5BU OS
  - 1 year ago
    - Cover test: 0.5-1LHypo
    - Accepts 2.0BU OS

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Case 5 – 65 year old, Caucasian Female

- Entering Acuity: 20/20 OU, Ocular Health Normal
- Cover Test: (primary gaze) - WORSE
  - Distance: 5LHypotropia
    - Right Tilt= Left Tilt, OD = OS Fixating
  - Near: 5LHypo(T), 2exophoria
- Cover Test: Nine Fields of Gaze unable due to mild abduction restriction OS
- Vertical Vergences from fusion point (4BU over OS)
  - BU 4/0
  - BD 3/1
- OS Ptosis: PAS 12mm OD, 10mm OS – STABLE difference
- OS Proptosis: Hertel Base 92, 14mm OD, 21mm OS- WORSE OS
- Mild retropulsion of globe with pressure OS>OD
- Plan?

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Diagnosis: Primary Lacrimal Gland Tumor

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Management: Refer to Oculoplastics for removal, return if diplopia remains post-op

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Orbital Tumors

- Symptoms
  - Persistent/progressive swelling of outer third of eyelid
  - Pain
  - Double vision
- Signs
  - Chronic eyelid swelling
  - +/- Proptosis
  - +/- Globe displacement
  - Extraocular motility restrictions
  - Palpable Mass

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Orbital Tumor

- **Etiology/Differential Diagnosis**
  - Sarcoidosis
  - Orbital Inflammatory Pseudotumor
  - Infectious
  - Benign mixed epithelial tumor
  - Dermoid cyst
  - Lymphoid Tumor
  - Adenoid Cystic Carcinoma
  - Malignant mixed epithelial tumor
  - Lacrimal glad cyst

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Differential Diagnosis

- Ptosis
  - Myogenic
    - Congenital, muscular dystrophy, chronic progressive external ophthalmoplegia
  - Aponeurotic
    - Aging (levator dehiscence), eye rubbing, RGP use
  - Neurogenic
    - CN III palsy
    - Horner syndrome
    - Myasthenia gravis
    - Marcus Gunn jaw-winking syndrome
  - Mechanical
    - Retained CL
    - Upper eyelid inflammation (GPC, chalazion(
    - Neoplasm
  - Traumatic
  - Pseudoptosis (contralateral eyelid retraction)
- Proptosis
  - Mass effect
    - Inflammation – thyroid, idiopathic, sarcoidosis, sinusitis, Wegener granulomatosis, etc
    - Infectious – orbital cellulitis, subperiosteal abscess, mucormycosis
    - Neoplastic
  - Trauma
    - Retrobulbar hemorrhage
    - Carotid-cavernous fistula
  - Malformation
    - Skeletal
    - Genetic/congenital
    - Enlarged globe (myopia)
  - Vascular
    - Caroid-cavernous fistula
    - Lymphangioma

Bagheri N, Wajda BN, The Wills Eye Manual 7th ed. 2017: Wolters Kluwer. China

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Case 5 Pearls

- Know the differential diagnosis of ptosis and proptosis
- Don't forget to measure the orbit!
  - Exophthalmometry
  - Palpebral aperture size, MRD1/2
- Documentation is important to observe for change over time
- Digital retropulsion test can feel for a mass in the eyelid

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BONUS Case: 52yo African American Male Referred for Post-Concussion Diplopia

- Chief Complaint: Diplopia
  - Started 4 weeks earlier when he was in a MVA
  - Constant
  - At all distances but variable in direction/magnitude
  - Mostly vertical
  - Image tilted in the left eye

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Initial Differential Diagnosis

Traumatic CN IV Palsy

Presentation – Vertical worse in down gaze

- Superior Oblique – depressor, incyclotorsion
- HYPER, EXCYCLOTORSION

Pathophysiology

- Longest course from CNS to target muscle – more prone to trauma than III and VI
- Decompensated congenital CNIV palsy has abnormally large vertical deviation vs acquired
- Traumatic origin not uncommon
- CNIV>CNIII>CNVI

Kim JH, Choi HY, Jeon H. Clinical Characteristics for Predicting Recovery of Acquired Fourth Cranial Nerve Palsy. J Neuroophthalmol. 2022 Jun 1;42(2):234-238.

Traumatic CN III Palsy

Presentation– Vertical worse in upgaze

- Superior Division: Superior Rectus – elevator, Levator – Eyelid elevation
  - HYPO, PTOSIS
- Inferior Division: Medial Rectus – Adduction, Inferior Oblique – Elevator, excyclotorsion. Inferior rectus – Depressor, Parasympathetic Pupillary innervation
  - EXO, HYPO, +/- MYDRIASIS

Pathophysiology

- Trauma: Rootlet avulsion, distal fascicular damage, stretching of nerve, decreased blood supply, uncal hernation (mass effects cause crowding/traps CNIII against the sharp edge of the tentorium) → frontal lobe injury
- RARE to have isolated CNIII palsy with normal neuro-imaging (moderate+ TBI)

Kim T, Nam K, Kwon BS. Isolated Oculomotor Nerve Palsy in Mild Traumatic Brain Injury. Am J Phys Med Rehabil. 2020 May;99(5):430-435.

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Comitancy

Clinical Tests of Comitancy
- Primary vs. Secondary Angle
- CT in 9 Fields of Gaze

OD fixating: 10LHyper
OS Fixating: 2LHyper

Findings
- Left Hyper → Left CNIV Palsy
- Right Hyper → Right CNIV Palsy
- V Pattern Eso → Bilateral CNIV OR Partial CNVI palsy

8LHyper/3Eso	3LHyper/4Eso	3RHyper
6LHyper/12Eso	3RHyper/10Eso	5RHyper/4Eso
6LHyper/25Eso	30Eso	10RHyper/20Eso

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Ancillary Testing

- Pupils: PERRL (-) APD
- Ocular Health: Normal OU
- Exophthalmometry: 16mmHg OD/OS
- Eyelids : Mild Ptosis OS
  - MRD1 3mm OD, 1mm OS
  - MRD2 5mm OD, 5mm OS
  - Levator Function – 10mm OD/OS

Other CN Testing

- CNI – Normal
- CNII – Normal VA, VF, Color, Pupils, Ocular Health
- CNV – Partial numbness on lower left side of face
- CNVII – Brow ptosis/facial ptosis
- CNVIII through CNVII – Normal

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Signs of Neuro-Ophthalmological Emergencies

- Optic nerve edema or pallor
- Extraocular/intraocular abnormality
  - Multiple cranial nerve palsies
  - Pupil-involving CN III Palsy
- Anisocoria
- Ptosis

- PEARL for Concern: If you have more than one of the following
  - Pupil abnormality
  - Eyelid abnormality
  - EOM abnormality

Karmel M, Eggenberger E. Deciphering Diplopia. Eye Net. Nov/Dec 2009. PP31-34

83

Management

- ER (Called ahead – got ER physician on the phone)
- Diagnosis: CSF leak at the base of his skull
- Referred to Neurosurgery
- Sees me q4-6weeks for stability check

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Signs and Symptoms of CSF Leak

- Low pressure (orthostatic) headache – 92%
- Nausea – 54%
- Neck pain – 43%
- Loss of smell or taste
- Tinnitus
- Otorrhea
- Rhinorrhea
- Oculorrhea extremely rare

- Most common cause – craniofacial trauma
  - Skull base fractures occur in 4% of head injury that present to the ED ~21% of all skull fractures
  - Predominantly in males (78%) with mean age 49

Taylor CA, Bell JM, Breiding MJ, Xu L. Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations, and Deaths - United States, 2007 and 2013. MMWR Surveill Summ. 2017 Mar 17;66(9):1-16.
Koehy K, Schnakenburger M, Stark R, Fitzgerald M. Delayed onset sequential bilateral abducens nerve palsies secondary to traumatic CSF leak. Trauma case reports. 2022. 38
Severson M, Schaurich CG, Stracker-McGraw MK. Cerebrospinal Fluid Leak. [Updated 2023 Mar 6]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK538157/

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