Neuro Exam for the Hospitalist

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Disclosures

WE HAVE NO DISCLOSURES.

Objectives

At the conclusion of this session, participants should be able to:

- Describe the components of a neurologic exam
- Demonstrate performing a full neurologic exam
- Explain normal and abnormal findings in a neurologic exam

Medical Equipment for the Basic Neuro Exam

- A good penlight - bright, focused light source
- Safety pin/blunt needle
- Reflex hammer

mdfinstruments.com

Case #1: Stroke Alert

- 60 y/o M with hypertension, hyperlipidemia, and type 2 diabetes mellitus who presents with sudden onset of right lower facial droop, right sided weakness, and trouble speaking. His symptoms started while on a Zoom meeting. Last known well was 1 hour prior to arrival.

On exam...

- Patient appears visibly frustrated, but in no acute distress.
- Awake and alert. Oriented to self. Cannot name simple objects and has difficulty following simple commands.
- Patient is only looking to the left and cannot see objects in the right peripheral fields of both eyes.
- Notable right sided facial droop, right sided extremity weakness and numbness to light touch and pinprick.

NIH Stroke Scale

1a. Level of Consciousness
1b. Orientation: What month is it? How old are you?
1c. Commands: "Close your eyes" and "Give me a thumbs up"
2. Visual Gaze
3. Visual Fields
4. Facial Weakness

NIHSS cont.

5a. Motor Arm Right (10 seconds)
5b. Motor Arm Left
6a. Motor Leg Right (5 seconds)
6b. Motor Leg Left
7. Limb Ataxia
8. Sensation
9. Best Language – cards
10. Dysarthria - "Mama," "Tip-top," "Baseball Player"
11. Extinction

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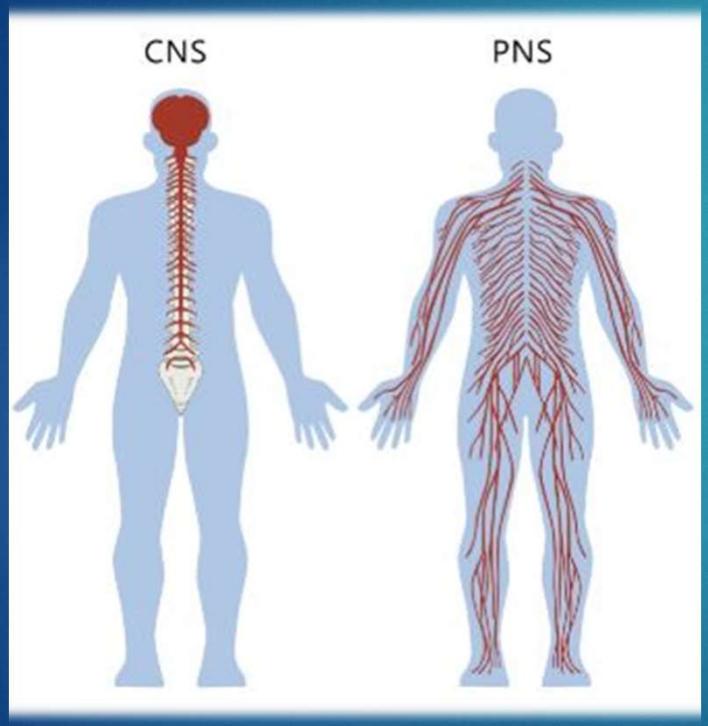
NIH Stroke Scale

1a. Level of Consciousness	**0 – alert, requires no stimulus** 1 – arouses to minor stimulus 2 – arouses to pain/ strong stimulus 3 – unresponsive or posturing
1b. Orientation: What month is it? How old are you?	0 – answers both correctly **1 – answers one question correct** 2 – answers zero questions correct
1c. Commands: "Close your eyes" and "Give me a thumbs up"	0 – follows both commands correctly **1 – follows one command correctly** 2 – completes neither task correctly
2. Visual Gaze	0 – normal extraocular movements 1 – partial gaze palsy in 1 or both eyes **2 – forced gaze deviation not able to be overcome**
3. Visual Fields	0 – normal vision 1 – partial hemianopia 2 – complete hemianopia **3 – bilateral hemianopia or blind**
4. Facial Weakness	0 – no weakness, symmetric face 1 – minor paralysis (nasolabial flattening) **2 – partial paralysis (total lower face weakness)** 3 – complete paralysis (upper + lower face)

NIHSS cont.

5a. Motor Arm Right (10 seconds)	0 – no drift 1 – drifts down but does not hit the bed **2 – some antigravity, but drifts down to the bed** 3 – some movement, but no effort against antigravity 4 – no movement
5b. Motor Arm Left	**0 – no drift**
6a. Motor Leg Right (5 seconds)	0 – no drift 1 – drifts down but does not hit the bed **2 – some antigravity, but drifts down to the bed** 3 – some movement, but no effort against antigravity 4 – no movement
6b. Motor Leg Left	**0 – no drift**
7. Limb Ataxia	**0 – no dysmetria present** 1 – dysmetria present in one limb 2 – dysmetria present in two limbs
8. Sensation	0 – normal sensation to light touch **1 – mild-moderate sensory loss** 2 – severe loss of sensation
9. Best Language – cards	0 – normal language 1 – mild-moderate aphasia, able to comprehend them **2 – severe aphasia, requires a great deal of questioning** 3 – mute or globally aphasic
10. Dysarthria - "Mama," "Tip-top," "Baseball Player"	**0 – normal** 1 – mild-moderate, slur but able to comprehend them 2 – severe, unintelligible speech or mute
11. Extinction	**0 – no abnormality** 1 – inattention to one modality 2 – profound inattention (evident in > 1 modality)

Central vs. Peripheral Nervous System



www.thepartnershipineducation.com/resources/nervous-system

Central Nervous System (CNS)

- Brain (Cerebrum, Brainstem, Cerebellum)
- Spinal Cord
- Upper motor neurons
- Role: Higher cortical functioning

Peripheral Nervous System (PNS)

- Brainstem/Spinal cord --> muscle
- Lower motor neurons

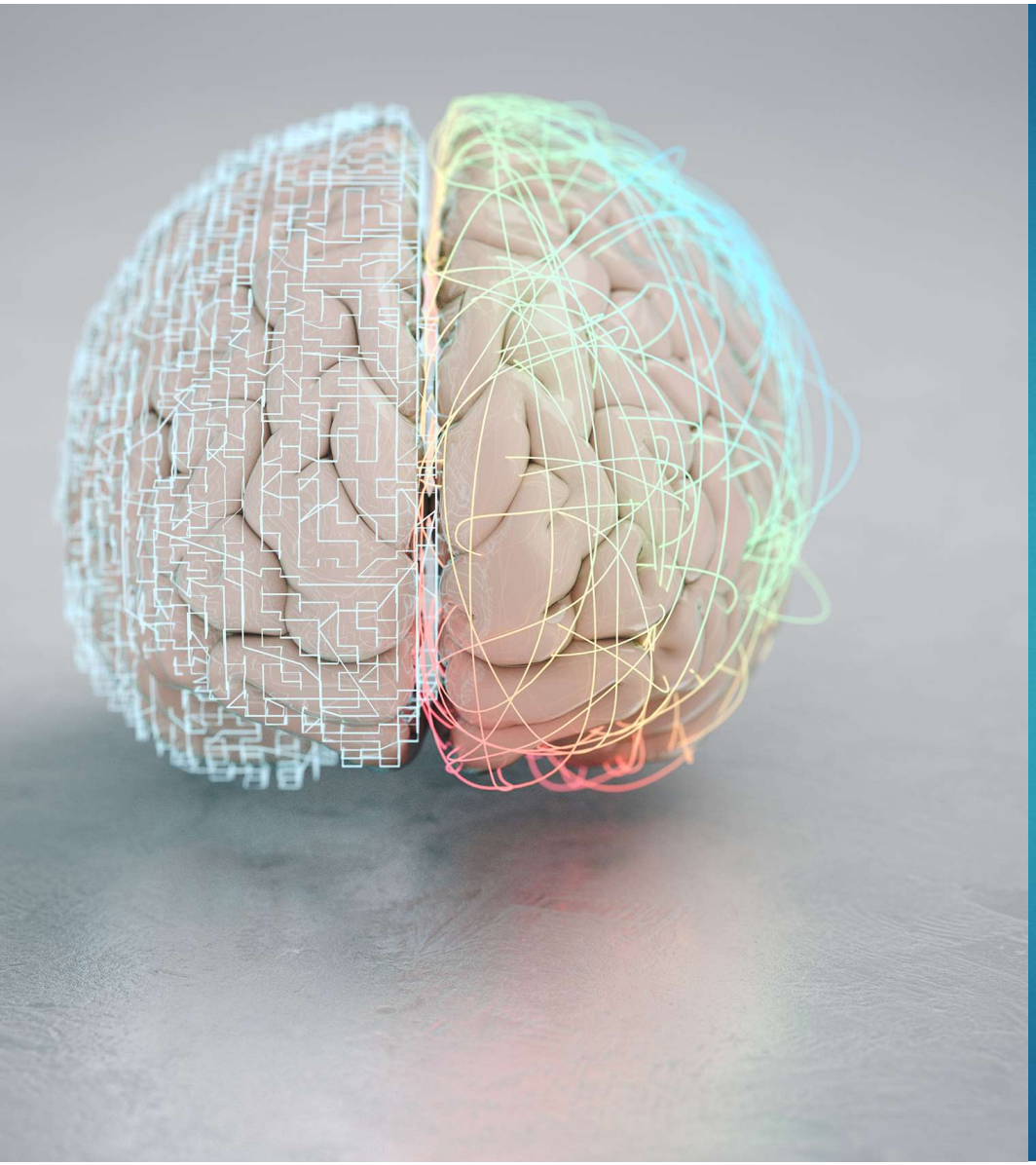
Left Hemisphere vs. Right Hemisphere

Left hemisphere

- Movement, sensation, & vision of the right side of the body
- Speech (typically)

Right hemisphere

- Movement, sensation, & vision of left side of the body
- Spatial awareness --> Neglect



Case #1 Localization

- Central Nervous System
  - Higher level of function (speech) affected
- Left Hemisphere
  - Right sided weakness and sensation changes
  - Aphasia (most speech centers are on the left)
  - Specifically -> Left Middle Cerebral Artery (MCA) territory stroke

Neurological Exam

- **Mental status**
- Speech/Language
- Cranial nerves
- Motor
- Sensory
- Reflexes
- Coordination
- Gait

Mental Status

- Consciousness
  - Alert, delirious, somnolent, obtunded, stuporous, comatose
- Attention/Concentration
  - **Digits forward -** patient repeats series of digits of increasing length: ex. 1, 4, 7, 5
    - < 5 attention deficit consistent with delirium
- Orientation
  - Informal: indicated by coherent history
  - Formal: person, place, time, situation (A&O x 4)

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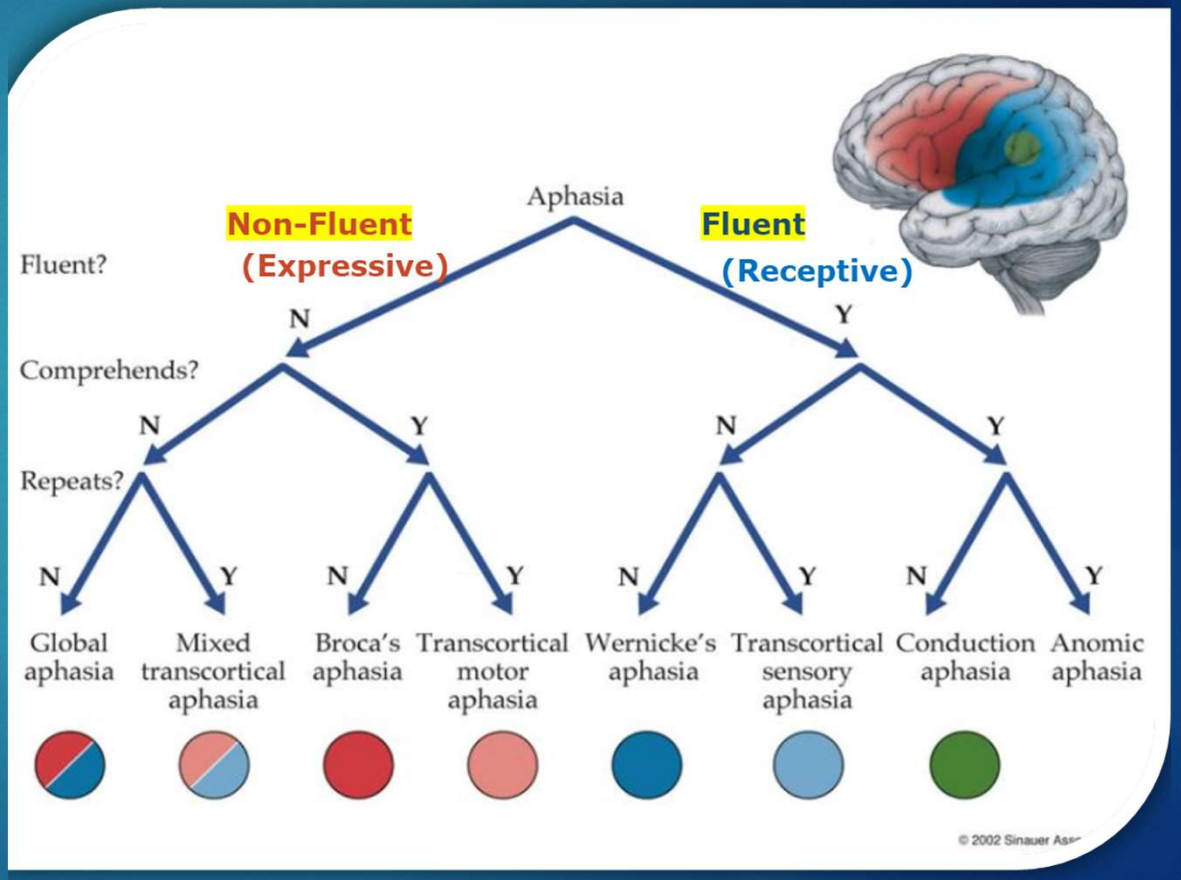
Speech/ Language

- **Dysarthria = Speech**
  - Impaired motor/coordination
  - Slurred, slow, abnormal rhythm, hypophonia, etc.
    - DDx: stroke, intoxication, angioedema, edentulous, infection, etc.
- **Aphasia = Language**
  - Problem with dominant cortex
    - DDx: stroke, seizure, encephalitis >> neoplasm, infection, TBI, etc.

Language Testing

- **Fluency**
- **Comprehension**
- **Repetition**
- **Naming**
- Writing
- Reading



Blumenfeld

Neurological Exam

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Cranial Nerves

Brainstem = Midbrain, Pons, Medulla

- CN 1 Olfactory
- CN 2 Optic

Midbrain

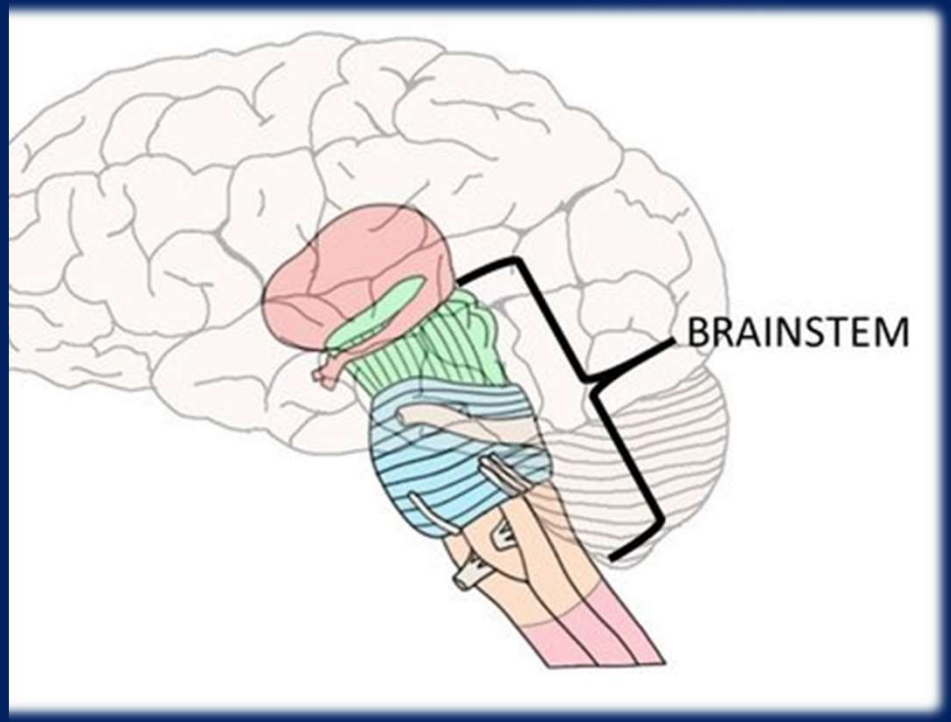
- CN 3 Oculomotor
- CN 4 Trochlear

Pons

- CN 5 Trigeminal
- CN 6 Abducens
- CN 7 Facial
- CN 8 Auditory

Medulla

- CN 9 Glossopharyngeal
- CN 10 Vagus
- CN 11 Accessory
- CN 12 Hypoglossal



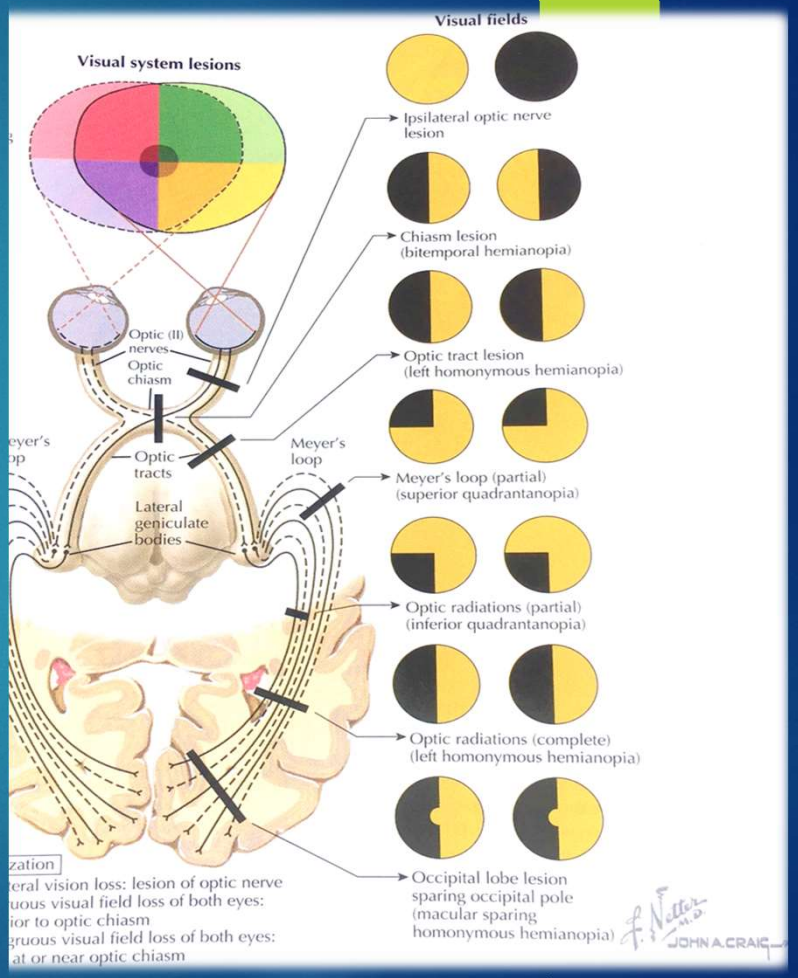
Neuroscientificallychallenged.com

Cranial Nerve Exam

- CN 1: Smell
- CN 2: Visual Fields, Pupils, Visual acuity, Fundoscopy, *blink to threat
- CN 3: *Pupils, Ptosis, Extraocular movements
- CN 4: Extraocular movements
- CN 5: Facial Sensation, *Corneal blink
- CN 6: Extraocular movements
- CN 7: Facial Motor, *Corneal blink
- CN 8: Hearing
- CN 9, 10: Palate Elevation & *Gag/Cough
- CN 11: Trapezius
- CN 12: Tongue protrusion

Visual Fields

- Finger movement or *Blink to threat (BTT)
  - Wiggle fingers, count fingers (1, 2, or 5)
  - BTT: coma or delirious patient
- Binocular = Brain



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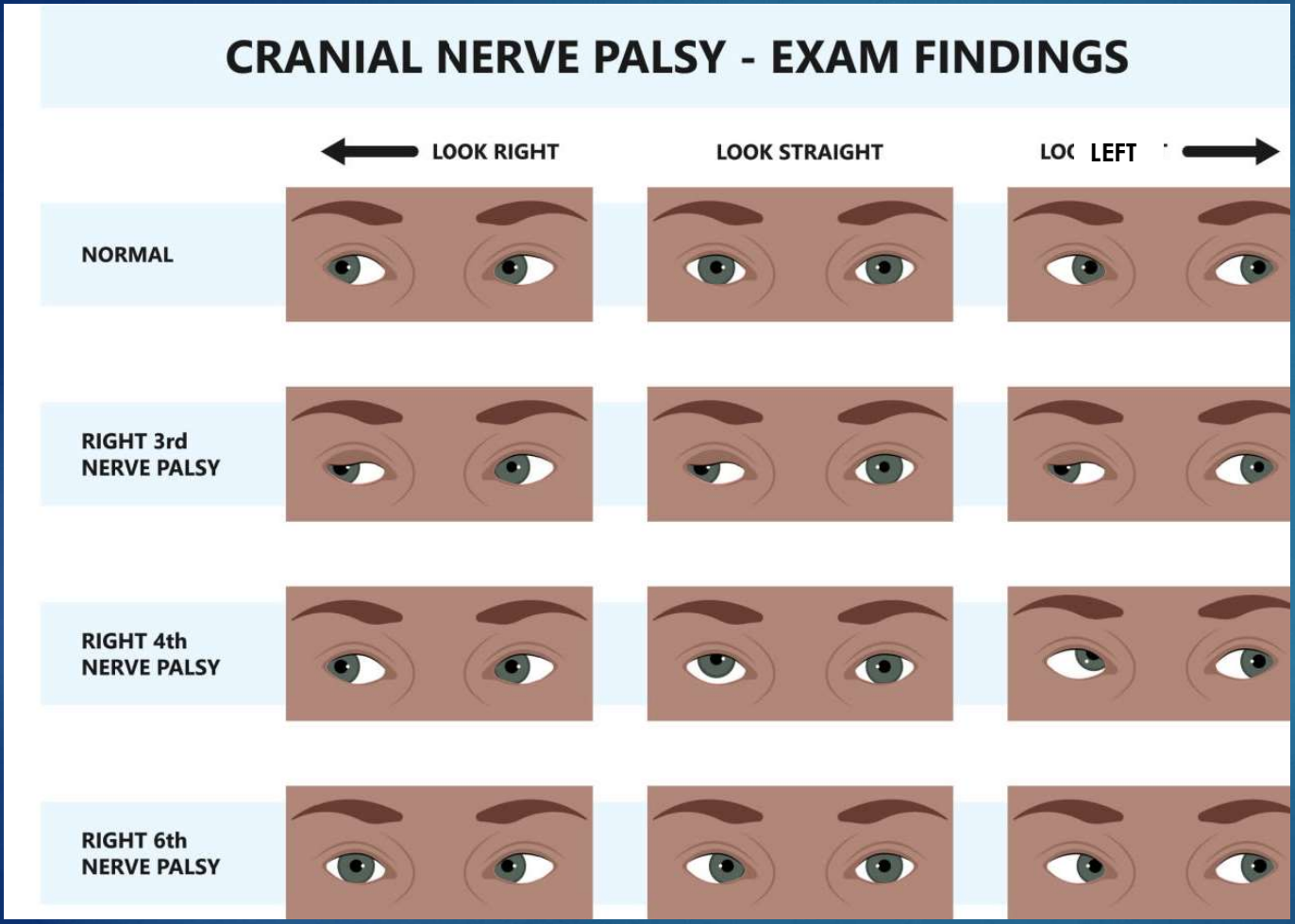
Oculomotor CN 3 (Midbrain)

- Pupillary response, Ptosis
- Anisocoria (≤1 mm is allowed)
  - Common causes: congenital, scopolamine patch, ipratropium nebs, trauma
  - Worrisome: Increased Intracranial pressure (ICP) 6
- Non-Reactive Pupil
  - Common causes: inadequate light, cataracts, prosthetic eye, surgery
  - Worrisome: Herniation
- Urgent CT head (non-contrast)



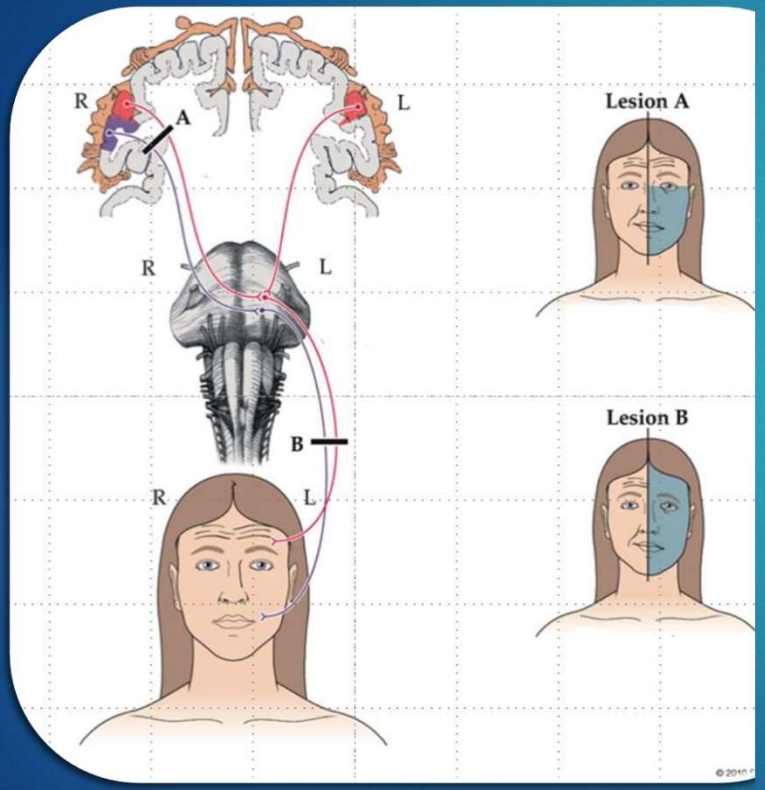
Cranial Nerve Palsy (CN 3, 4 - Midbrain, CN 6 - Pons)

- Conjugate gaze
- Letter "H"
- Bury the sclera

CN 5 (Pons)

- Facial Sensation V1, V2, V3
- Corneal blink reflex: CN 5 (V1) ➔ CN 7

CN 7 (Pons)



Exam:

- Smile - count teeth on each side
- Raise eyebrows

Blumenfeld

CN 8 (Pons)

CN 10 - 12 (Medulla)

- **CN 8** Vestibulocochlear Nerve
  - Exam: Hearing
- **CN 9/10** Glossopharyngeal/Vagus Nerve
  - Exam: Quality of voice, Palate, Gag, Cough
- **CN 11** Accessory Nerve
  - Exam: Shoulder shrug
- **CN 12** Hypoglossal Nerve
  - Exam: protrude tongue

Neurological Exam

- **Mental status**
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Motor

- Muscle Bulk (atrophy)
- Muscle Tone
- Strength Scale 0-5:
  - 0: No movement
  - 1: Muscle twitch/flicker
  - 2: Movement in the plane of the bed
  - 3: Anti-gravity
  - 4: Resistance
  - 5: Full strength

Weakness Patterns

- Unilateral or bilateral
- Proximal or distal
- Extensors or flexors

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Sensory

Posterior (Dorsal) Column

- Vibration
- Proprioception
  - Romberg

Spinothalamic Tract

- Temperature
- Pain (scratch)

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Reflexes

- 0+: Absent
  - Peripheral neuropathy, Guillain-Barre
- 1+: Hypoactive
  - hypothyroidism
- 2+: Normal
- 3+: Hyperreflexia with **spread**
  - Spread: pectoralis, suprapatellar, cross adductor
  - hyperthyroidism, spinal cord lesion
- 4+: Hyperreflexia with **clonus**

Reflexes Exam

- **Note:** Symmetry / Hyper- / Hypo- / Absent
  - Muscle should be in a relaxed position (not extended)
  - Feel the tendon, let hammer do the work
  - Compare left to right before moving to next muscle group

Clonus

Neurological Exam

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- **Reflexes**
- **Coordination**
- Gait

Coordination

- **Nystagmus**
  - Direction changing
- **Finger-nose-finger/Heel-to-shin (dysmetria)**
  - Extend elbow to full reach
- Rapid alternating movements (dysdiadochokinesia)
- Trunk
  - **Sitting/standing/walking**

Neurological Exam

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- **Gait**

Gait

Factors affecting gait: Visual, motor, sensory, cortex, basal ganglia, cerebellum

Antalgic - favoring one leg

Ataxic (Cerebellar) - wide based, poor balance, unable to tandem

- EtOH, stroke, tumor, cerebellar atrophy

Parkinsonian - slow rise/walk, shuffling, stooped, reduced arm swing

Practice Performing the Neurologic Exam

- Mental status
- Speech/Language
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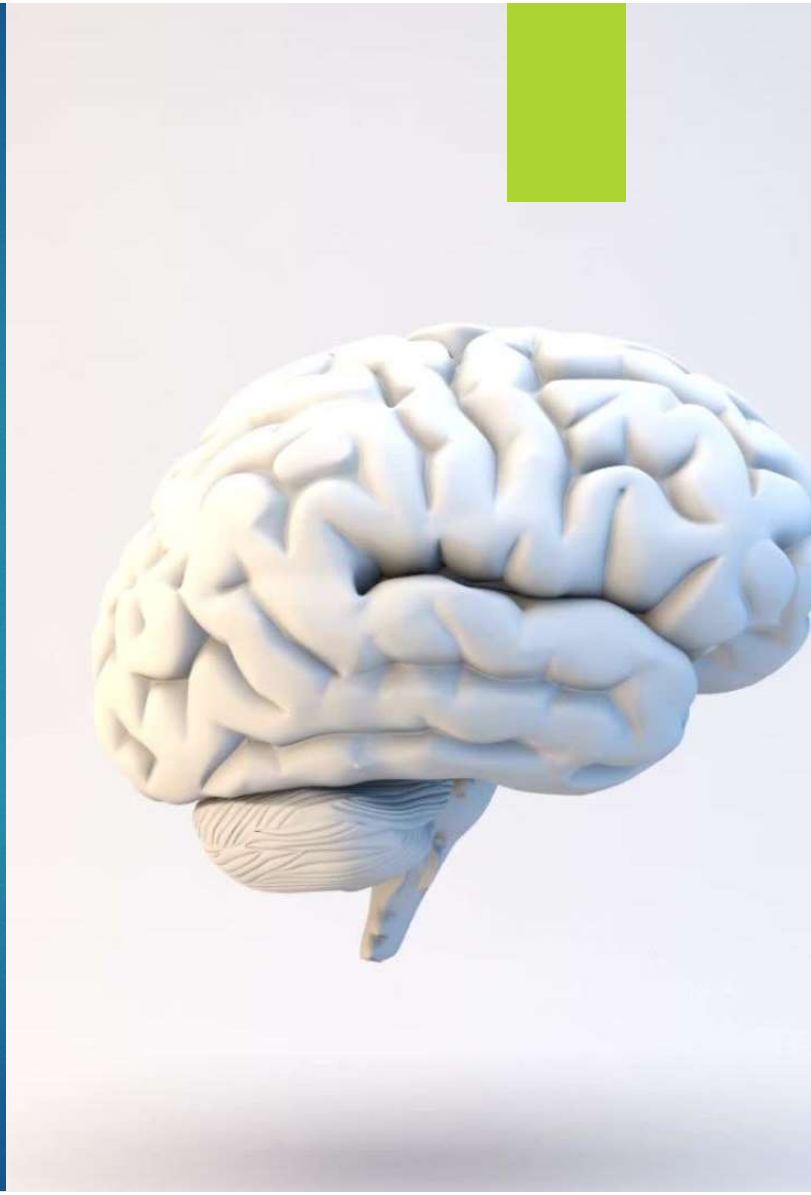
- Gait



Case #2: Coma Patient

- 65 yo F who suffered a cardiac arrest. Received CPR and did not achieve ROSC for 25 minutes. She is now intubated, off sedation and not waking up. Neurology is consulted for neuro prognostication.

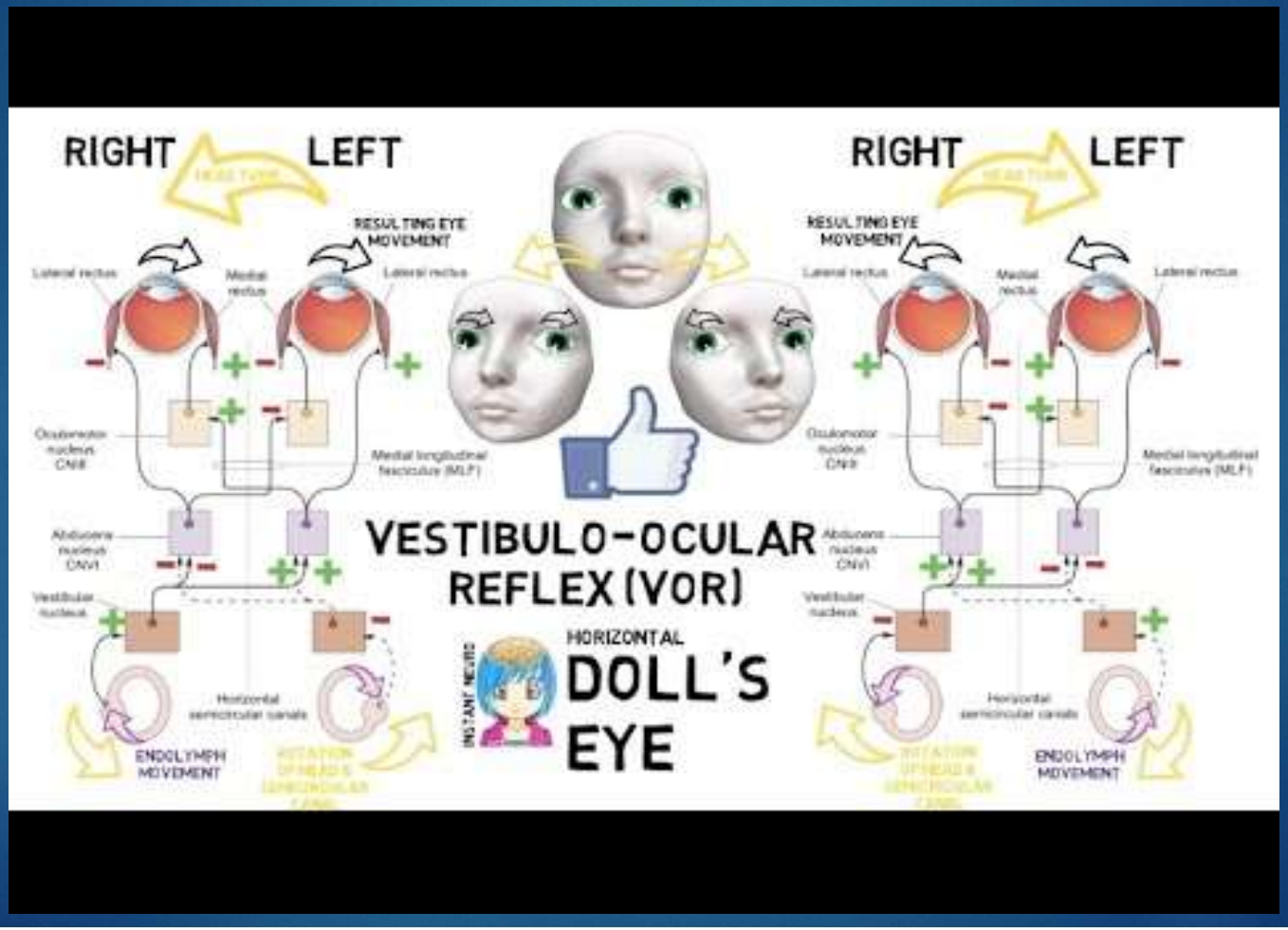
On exam...

- Patient does not awaken or move extremities to noxious stimuli.
- Pupils are equal and reactive to light bilaterally.
- Blink to threat intact bilaterally.
- Vestibulo-ocular reflex intact bilaterally.
- Corneal reflex intact bilaterally.
- Cough and gag reflexes intact.

Neuro Exam in a Comatose Patient

- Mental status – response to external stimuli
- Motor/sensory exam – can patient move their extremities/withdrawal? On command?
- Brainstem reflexes
  - Pupils: testing the midbrain (CN 2, 3)
  - VOR (doll's eyes): testing the pons (CN 3, 6, 8)
  - Corneal: testing the middle/lower pons (CN 5 & 7)
  - Cough reflex: testing the medulla (CN 9, 10)

Vestibulo-ocular Reflex



High Yield Neuro Exam: Take home points

1. Mental Status
   - Consciousness
   - Attention: Digits Forward (<5 & hospitalized = Delirious)
2. Language
   - Fluency / Comprehension / Repetition / Naming
3. Cranial Nerves
   - Visual Fields / Pupils / EOMs / Facial Weakness
4. Motor
   - Pronator Drift / Finger extensor / Hip Flexor / Dorsiflexion
5. Sensory
   - Pain/Temperature & Vibration/Proprioception
6. Coordination
   - Finger to Nose / Heel to Shin
7. Gait

Questions?

References

- Gensensway D. The high-yield neuro exam. Today's Hospitalist. https://www.todayshospitalist.com/the-high-yield-neuro-exam/. Published January 2012.
- Neuroscientificallychallenged.com
- Mdfinstruments.com
- INSTANT NEURO - Doll's Eye - YouTube
- www.thepartnershipineducation.com/resources/nervous-system
- Cranial Nerve Palsy – CN III, IV, VI & VII Palsy (allaboutvision.com)
- https://www.youtube.com/watch?v=4SrhgjGIZ30
- https://www.youtube.com/watch?v=MePMgSx1zew