The Neurological Examination
Neuro Exam Tools

128-Hz
7 categories of the neurological exam

- Mental status
- Cranial nerves
- Motor system
- Reflexes
- Sensory system
- Coordination
- Station and gait
7 components of the mental status exam

- Level of consciousness
- Attention
- Orientation
- Language — fluency, comprehension, repetition, naming, reading, writing
- Memory — immediate recall, recent, remote
- Higher intellectual function—general knowledge, abstraction, judgment, insight, reasoning
- Mood and affect
CNI: Olfactory nerve

• Cannot evaluate if nasal passages obstructed by rhinitis, polyps, etc.
• Eyes closed
• Occlude one nostril and test other
• Compare 2 sides
• Use nonirritating substances
  - Avoid those that stimulate trigeminal nerve endings or taste buds (e.g., peppermint, menthol, ammonia)
CNII: Optic nerve

- Visual acuity
- Visual fields
- Fundoscopy
- Afferent limb of pupillary function
**CNII: Visual acuity**

- Hold card at comfortable reading distance
- Cover 1 eye
- **Glasses on** (looking for optic nerve lesion, not refractive error)
CNII: Visual fields

Greenberg *Clinical Neurology*, 1993
CNII: Fundoscopic exam
CNII & III: Pupillary function

- Normal pupils are equal in size and shape and are situated in center of iris
- Pupillary size varies with intensity of ambient light, but at average intensity is \( \approx 3-4 \text{ mm} \)
  - *Miosis* < \( \approx 2 \text{ mm} \)
  - *Mydriasis* > \( \approx 5 \text{ mm} \)
  - *Anisocoria* = pupillary asymmetry
CNII & III: Light reflex

- Dim lights
- Fix gaze on opposite wall to eliminate effects of accommodation
- Shine bright light obliquely into each pupil
- Look for both direct (same eye) and consensual (opposite eye) reaction
- Record pupil size and shape
CNII & III: Accommodation

- Hold finger ≈10 cm from patient’s nose
- Alternate looking into distance and at finger
- Observe pupillary response
CNIII, IV, VI: Ocular nerves

- CNIII Oculomotor nerve
- CNIV Trochlear nerve
- CNVI Abducens nerve
- Visual inspection: ocular alignment, lids
- Convergence
- Smooth pursuits
- Saccades
- Nystagmus
- 6 cardinal directions of gaze
Smooth Pursuits
Saccades
Optokinetic Nystagmus
Extraocular movements

- Nasal:
  - Superior rectus
  - Inferior oblique
  - Medial rectus

- Temporal:
  - Lateral rectus
  - Inferior rectus
  - Superior rectus

- III:
  - Inferior oblique
  - Superior rectus

- IV:
  - Inferior rectus

- VI:
  - Superior oblique
CNV: Trigeminal nerve
**CNV:** Trigeminal nerve

- **Corneal reflex**
  (CN V-afferent limb
   CN VII-efferent limb)

- **Masseter strength**

- **Jaw jerk**
Corneal Reflex
CNVII Facial nerve
CNVIII: Auditory nerve

- **Hearing** (cochlear nerve)
  - Test with finger rubbing at arm’s length
    - If can’t hear strong rubbing → impaired
    - If can hear faint rubbing → normal
  - Tuning fork tests (Weber, Rinne) have extremely poor sensitivity
CNIX & X: Glossopharyngeal & vagus nerves

• Testing centers on motor function
  - Palate elevation
  - Swallowing
  - Voice
  - Cough
  - Gag reflex
Examination of the palate
CNXI: Spinal accessory nerve

- **Trapezius**
  - Push head back against resistance
  - Shrug shoulders

- **Sternocleidomastoid**
  - Place hand on lower face and have patient rotate head toward that side
  - Observe contraction of opposite SCM
CNXII: Hypoglossal nerve

- Note tongue position at rest and on protrusion
  - Does tongue deviate in either position?
- Note strength and rapidity of movements
- Have patient push tongue into each cheek
Motor exam

• Compare left to right, proximal to distal, arms to legs
  - Bulk (muscle mass)
  - Tone (muscle tension at rest)
    • Test with passive manipulation
  - Strength
  - Speed of movement; extraneous movement
  - Endurance
Muscle strength testing

Direct muscle strength testing more sensitive to lower (alpha) motor neuron dysfunction, while tests of dexterity/coordination more sensitive to upper motor neuron (corticospinal tract) dysfunction

- Isolate muscle
- Fix proximal joint when testing distally
- Always give yourself the advantage
- Increase sensitivity in lower extremities with heel/toe walking and deep knee bend
- Normal variability—age, sex, muscle, handedness
- “Giveaway weakness”
Grading muscle strength
(Medical Research Council scale)

0  No muscular contraction
1  Visible muscle contraction, but no movement at joint
2  Movement at the joint, but not against gravity
3  Movement against gravity, but not against resistance
4  Movement against some resistance, but < full
5  Movement against full resistance; normal strength
Upper extremity muscles you should know how to test

- **Deltoid**—abduction (elevation) of upper arm
  - (C5-6, axillary nerve)
- **Biceps**—flexion of forearm at elbow
  - (C5-6, musculocutaneous nerve)
- **Triceps**—extension of forearm at elbow
  - (C6-8, radial nerve)
- **Extensor carpi radialis**—dorsiflexion of hand at wrist
  - (C5-6, radial nerve)
- **Abductor pollicus brevis**—palmar abduction of thumb
  - (C8-T1, median nerve) w/ thumb at right angle to palm
- **Interrosei**—finger abduction (dorsal) & adduction (palmar)
  - (C8-T1, ulnar nerve)
Lower extremity muscles you should know how to test

- **Iliopsoas**—hip flexion
  - (L1-3, femoral nerve)
- **Quadriceps**—knee extension
  - (L2-4, femoral nerve)
- **Hamstrings**—knee flexion
  - (L5-S2, sciatic nerve)
- **Tibialis anterior**—ankle dorsiflexion
  - (L4-5, deep peroneal nerve)
- **Gastrocnemius/soleus**—ankle plantar flexion
  - (S1-2, tibial nerve)
Muscle stretch reflexes

- Biceps (C5, C6; musculocutaneous)
- Triceps (C6, C7; radial)
- Patellar (L2-L4; femoral)
- Ankle (S1-S2; tibial)

Reflex grading

0 absent
1 hypoactive
2 normal
3 brisk/hyperactive
4 markedly hyperactive with clonus
Biceps reflex
Triceps reflex
Knee Jerk
Ankle Jerk
Reflexes: Reinforcement

- Isometric contraction of other muscles (Jendrassik maneuver, teeth clenching)
- Distraction
- Slight tension in muscle group being tested
Superficial reflexes

- **Plantar** (L4-S2, esp S1; tibial nerve)
  - Babinski, etc.
  - **Normal response** = flexion (toes go down)
  - **Abnormal response** = extension (dorsiflexion of great toe as the extensor hallucis longus is recruited)
- **Sign of hyperexcitability associated with corticospinal dysfunction**
Plantar reflex
Plantar reflex
Sensory Exam: General Points

- Explain each test before you do it
- Patient’s eyes should be closed during testing
- Test all 4 extremities
- Avoid leading questions like “Is this sharp?”
- Compare side-to-side and distal-to-proximal asking if they are “about the same”
- When you detect an area of sensory loss, map out its boundaries in detail
Sensory exam

• Primary sensation
  - Pain and temperature
  - Light touch/pressure
  - Vibration
  - Proprioception

  Characterize as normal, absent, reduced, exaggerated, or perverted (*dysesthesias*)

• Integrative sensation
  - Graphesthesia
  - Stereognosis
  - Double simultaneous stimulation
Vibration sense

- 128-Hz tuning fork
- Test toe & finger
- What do you feel?
- Count seconds til stops
- Compare side to side
- If impaired, move proximally
Joint position sense

- Test toes and fingers
- Move digit only a few degrees
- If impaired, move digit greater distance -> test more proximally
Pain sensation

- Test for distal gradient of sensory loss in the leg
- Test for sensory loss in most commonly affected nerve and nerve root distributions
  - Palmar aspect of index finger (median nerve).
  - Palmar aspect of 5th finger (ulnar nerve)
  - Web space between thumb and index finger on dorsal surface of hand (radial nerve).
  - Lateral surface of foot (L5).
  - Posterior aspect of leg (S1).
- Ask patient if the sensation is “about the same”
Light Touch & Double Simultaneous Stimulation

• Lightly touch face and extremities in random order, asking patient to respond whenever a touch is felt.

• Touch both sides of face or body simultaneously, asking patient to indicate whether touch is felt on left, right, or both sides.
Stereognosis & Graphesthesia
Romberg sign

- Ability to maintain upright position with feet together and eyes open
- Sway/fall when eyes closed
- Indicates impaired proprioception or vestibular dysfunction
Coordination

- Control, precision, rhythm, synergy of movement
- Test at rest and with action in trunk and limbs
  - Finger-nose-finger
  - Rapid alternating movements
  - Heel-knee-shin
  - Finger or toe tapping
Gait

- Posture of body and limbs
- Length, speed, and rhythm of steps
- Symmetry and base of gait
- Steadiness
- Arm swing
- Turns
- Test with normal gait, toe walking, heel walking, tandem walking
Meningeal signs

- Neck mobility—look for nuchal rigidity (neck stiffness)
Recommended resource:

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