Neurologic Examination Benchmarks

Preparation & positioning

A complete neurologic exam can be done following the musculoskeletal exam, or the neurologic exam can can be integrated into the exam of each region of the body. Cranial nerves could be examined at the time of the head and neck exam; strength could be tested during the musculoskeletal examination. Most ambulatory patients will be seated for the majority of the exam. Hospitalized patients may be supine.

On completion of FCM, students should be able to demonstrate each step in a comprehensive neurologic exam**:**

1. Mental Status	Observe the level of consciousness
	Observe speech and language
	Assess orientation to person, place, and time
	Assess short term memory
2. Cranial Nerves	Test visual acuity & visual fields for each eye alone (CN II)
	Test pupillary reaction (CN II and III)
	Test eyelid opening (CN III)
	Test extra-ocular movements (CN III, IV, VI), observing for nystagmus (CN VIII)
	Test facial sensation & muscles of mastication (CN V)
	Test muscles of facial expression (CN VII)
	Test hearing (CN VIII)
	Test palatal rise to phonation (CN IX and X)
	Test sternocleidomastoid & upper trapezius muscle strength (CN XI)
	Test tongue protrusion (CN XII)
3. Motor Function	Assess strength, bulk, and tone of: Upper extremity muscle groups: Shoulder abductors, arm flexors & extensors, wrist flexors & extensors, finger flexors, finger abductors Lower extremity muscle groups: Hip flexors, extensors, abductors & adductors; knee flexors & extensors, foot dorsiflexors & plantar flexors Pronator drift
4. Reflexes	Upper extremity: biceps, triceps, & brachioradialis
	Lower extremity: patellar & Achilles
	Plantar reflex
5. Sensation	Romberg test**.**
	In patients with neurologic concerns, assess sensation with at least two modalities, including pin prick and either vibration, joint position sense, or light touch
6. Cerebellar Testing	Finger-to-nose test
	Heel-to-shin test
	Gait

Let's explore each of these steps further…

1. Mental Status	Observe the level of consciousness
	Observe speech and language
	Assess orientation to person, place, and time
	Assess short term memory

Technique and tips:

- Your initial evaluation of mental status will occur as you greet and establish rapport with the patient. Most ambulatory patients are alert and oriented; decreased level of consciousness and confusion are much more common in the hospital, and mild cognitive impairment is common in the elderly. More formal questioning about orientation and recall is appropriate on initial evaluation of these patient groups.
- The Mini-Cog is ascreening test for short term memory loss associated with cognitive impairment.
    - Give your patient a list of three items, for example: Apple-Penny- Ball. Ask him to repeat them immediately and remember them for 5 minutes.
    - Give the patient a piece of paper with a circle drawn on it. Instruct him to draw a clock, placing the numbers on the clock face, with the hands pointing to a certain time.
    - Then ask him to recall the 3 items.

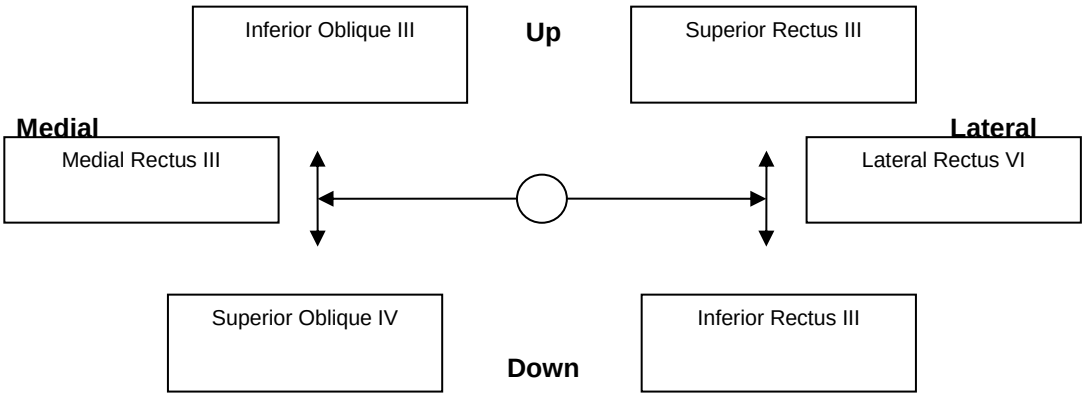
Common abnormal findings:

- Decreased level of consciousness. Levels of consciousness are defined as:
    - **Alert:** awake, with a normal level of consciousness.
    - **Lethargic:** sleepy and requires stimulation to maintain an awake state.
    - **Stuporous:** cannot be aroused to a fully awake state. May respond semi-purposefully to stimulation.
    - **Comatose:** no purposeful response to any type of stimulation.
- Three item recall and mini-Cog
    - Recall of 0 items indicates cognitive impairment.
    - Recall of 1-2 items with an abnormal clock face indicates cognitive impairment.
    - Recall of 1-2 items with a normal clock face indicates no cognitive impairment.
    - Recall of all 3 items indicates no cognitive impairment.
    - Interpreting the mini-Cog
- Abnormalities of speech or language include:
    - **Aphasia:** disorder of language that manifests as problems with comprehension, fluency, naming, arithmetic and/or writing. Caused by stroke and other brain disorders involving language areas of cortex.
    - **Dysphonia:** disorder of voice production caused by abnormal larynx or vocal cord function.
    - **Dysarthria:** disorder of articulation caused by abnormal motor control of the pharynx, palate, tongue, lips and/or face.

2. Cranial Nerves	Test visual acuity & visual fields for each eye alone (CN II)
	Test pupillary reaction (CN II and III)
	Test eyelid opening (CN III)
	Test extra-ocular movements (CN III, IV, VI), observing for nystagmus (CN VIII)
	Test facial sensation & muscles of mastication (CN V)
	Test muscles of facial expression (CN VII)
	Test hearing (CN VIII)
	Test palatal rise to phonation (CN IX and X)
	Test sternocleidomastoid & upper trapezius muscle strength (CN XI)
	Test tongue protrusions (CN XII)

Technique and tips:

- Visual field testing. Remember that one eye should be covered and one eye tested at a time. The patient sits ~ 3 feet from the examiner and stares at her nose. The examiner moves an object or finger from the back of the patient's head into each quadrant of the visual field, asking the patient to report when he can see it.
- Pupillary reaction. Observe direct and consensual reaction of each pupil. The parasympathetic nervous system constricts the pupil and arrives at the eye via CN III. The sympathetic nervous system dilates the pupil and arrives via branches from the nerve plexus along the internal carotid artery. Pupillary size is determined by the balance of these two inputs.
- Extraocular motion. The eye muscles are tested by asking the patient to look in 6 directions. The muscle tested in each direction is shown for the left eye.



Common abnormal findings:

- **Anisocoria:** To determine the cause of unequal pupils, compare the degree of asymmetry in light and dark, If the degree of asymmetry is:
  - **The same in light and dark:** The patient has physiologic anisocoria, a normal variant in 20% of the population.

- **Greatest in light:** The patient has a parasympathetic problem in the larger pupil. Look for other signs of CNIII dysfunction, such as ptosis or dysconjugate gaze.
- **Greatest in dark:** The patient has a sympathetic problem in the smaller pupil. Look for other signs of Horner syndrome, such as decreased facial sweating and ptosis.

- **Facial weakness.** A central or peripheral lesion of the 7th cranial nerve will cause unilateral facial nerve palsy. Central and peripheral 7th nerve lesions can be differentiated by how much of the face is involved. Central facial nerve palsy affects only the lower face, as the motor neurons innervating the forehead receive input from both sides of the brain. Peripheral facial nerve palsy affects the entire face.

- **Tongue weakness.** Each genioglossus muscle pushes the tongue out and to the opposite side, so the tongue deviates to the side of weakness. Unilateral atrophy and twitching are also signs of weakness.

3. Motor Function	Assess strength, bulk, and tone of: Upper extremity muscle groups: Shoulder abductors, arm flexors & extensors, wrist flexors & extensors, finger flexors, finger abductors Lower extremity muscle groups: Hip flexors, extensors, abductors & adductors; knee flexors & extensors, foot dorsiflexors & plantar flexors Pronator drift

Technique and tips:

- Isolate the muscle you are testing. Fix the limb above the joint that it moves with one hand. If you are testing the biceps muscle, which flexes the arm at the elbow, fix the arm above the elbow with one hand while your other hand assesses strength. Exceptions are deltoids, which are usually tested simultaneously to avoid tipping the patient, and the intrinsic muscles of the hand.
- Test triceps strength with the arm flexed 90 degrees at the elbow

Grading strength
0 = no movement
1 = flicker of movement or slight twitch
2 = moves with gravity eliminated
3 = moves against gravity but not against resistance
4 = moves against resistance but less than full power
5 = normal strength or power

Common abnormal findings:

- Weakness can be a finding of central or peripheral motor neuron disease or disorders of the neuromuscular junction or muscle.
- Atrophy describes muscles that are wasted. Muscle bulk varies substantially across patients – compare one side to the other. Atrophy suggests disuse of the muscle or lower motor neuron disease.
- Increased muscle tone can be caused by central nervous system disease (spasticity) or extrapyramidal disorders such as Parkinson's disease (rigidity).

4. Reflexes	Upper extremity: biceps, triceps, & brachioradialis
	Lower extremity: patellar & Achilles
	Plantar reflex

Technique and tips:

- Deep tendon reflexes are compared side-to-side, and are graded on a 0-4 scale:

0 = absent
1 = present but less than normal
2 = average
3 = increased
4 = clonus

  Absent or exaggerated reflexes are sometimes seen in normal people. If the reflexes are symmetric and there are no other findings of nervous system disease, no further evaluation is needed.
- Brachioradialis reflex: Elicit this reflex by tapping your fingers placed on the lateral arm, midway between the wrist and elbow. Look for contraction of the brachioradialis in the lateral arm around the elbow.
- Plantar (Babinski) reflex: Begin with a *gentle* stimulus (such as a thumbnail) drawn from the heel along the lateral sole and over the metatarsal heads. If there is no response to gentle pressure you can use firmer pressure. Normal in patients over the age of 1 is downward movement of the toes.
- Augmentation maneuvers: If you can't elicit a reflex, repeat as your patient performs these maneuvers:
    a. For upper extremity reflexes: Clenches the jaw and counts to 20
    b. For patellar reflex: Hooks the fingers of the right and left hands firmly together and pulls.
    c. Achilles reflex: Presses down lightly on your hand, as if 'stepping on the gas'

Common abnormal findings:

- Absent or reduced reflexes. Peripheral nervous system disease causes absent or decreased reflexes, but normal people and those with sensory loss can demonstrate similar findings. Associated weakness, atrophy, or fasiculations all suggest lower motor neuron disease as the cause.
- Exaggerated reflexes. Upper motor neuron disease causes exaggerated reflexes, which can again be seen in normal people. Associated weakness, spasticity, or an abnormal plantar reflex all suggest upper motor neuron disease as the cause.
- Abnormal plantar reflex (also called the Babinski sign): The abnormal finding, which indicates upper motor neuron disease, is upward movement of the big toe.

5. Sensation	Romberg test
	In patients with neurologic concerns, assess sensation with at least two modalities, including pin prick and either vibration, joint position sense, or light touch

Technique and tips:

- **Sensory testing:** The most important part of the sensory evaluation is the patient's report of any problems. If a patient reports abnormal sensation in any part of the body, focus on that part of the body, testing with all 4 modalities. If you are concerned about asymptomatic peripheral neuropathy (for example, in patients with diabetes) evaluate pinprick and light touch in the toes. If a patient has no sensory complaint, you may screen sensation with pin prick or light touch in each limb.

Abnormal findings:

- **Romberg test:** A positive Romberg test is an inability to stay upright with the feet together after the eyes are closed. It indicates a loss of lower extremity position sense from neuropathy or a posterior column problem.

6. Cerebellar Testing	Finger-to-nose test
	Heel-to-shin test
	Gait

Technique and tips:

Weakness, numbness, or vision problems will interfere with your patient's ability to perform these tests.

- **Finger-to-nose test:** Holding your hand in front of the patient, ask him to touch his nose then your finger, going back and forth. Observe for smoothness and accuracy, comparing the right and left sides. Unilateral incoordination indicates a problem with the cerebellum on that side
- **Heel-to-shin test**: Ask the supine patient to place one heel on the opposite shin, and run the heel up and down the shin. Observe for smoothness and accuracy, comparing the right and left sides.
- **Gait:** Ask the patient to walk across the room, turn and walk back. Then ask him to walk heel to toe in a straight line. Normal people over the age of 60 are often unable to heel-to-toe walk.

Abnormal findings:

- Recognize these abnormal gaits:
  - Neuropathic
  - Myopathic
  - Ataxic
  - Hemiplegic