Cranial Nerves

There are 12 pairs of cranial nerves, which are assigned Roman numerals I through XII. Most of the cranial nerves are named for their function, such as the optic nerve, which is responsible for transmitting visual information. The cranial nerves are made up of motor neurons, sensory neurons, or both. They are peripheral nerves that arise from the brain and connect the muscles and sensory organs of the head and thorax directly to the brain. Each cranial nerve is paired and is present on both sides of the brain hemisphere.

One of the most important and complex cranial nerves is the vagus nerve, or cranial nerve X. It is the longest of the cranial nerves and originates in the brainstem, extends down to the abdomen, and connects to many organs and glands along the way, including the heart, lungs, digestive system, and liver. It has both sensory and motor neurons and plays a role in controlling unconscious body functions such as heart rate, digestion, and respiratory rate.

Remembering the Order and Function of the Cranial Nerves

Many mnemonics have been developed to aid in remembering the order and function of the cranial nerves. For example, to remember the order of the cranial nerves think, “On Old Olympus Towering Tops, A Finn And German Viewed Some Hops.” To remember the sensory and/or motor function of the cranial nerves, think, “Some Say Marry Money, But My Brother Says Bad Business Marry Money.”

	Cranial Nerve	Order	Function
I	Olfactory	On	Some (sensory: sense of smell)
II	Optic	Old	Say (sensory: vision)
III	Oculomotor	Olympus	Marry (motor: movement of the eyelids, dilation of the pupil, and coordinated movement of the eyes)
IV	Trochlear	Towering	Money (motor: movement of the eyelids, dilation of the pupil, and coordinated movement of the eyes)
V	Trigeminal	Tops	But (both sensory and motor: sensation of the face, corneal reflexes, and jaw movements)
VI	Abducens	A	My (motor: movement of the eyelids, dilation of the pupil, and coordinated movement of the eyes)
VII	Facial	Finn	Brother (both sensory and motor: facial movement, taste and salivation)
VIII	Acoustic	And	Says (sensory: sense of hearing and balance)
IX	Glossopharyngeal	German	Bad (both sensory and motor: sense of taste, movement of tongue for swallowing/gag reflex and phonation)
X	Vagus	Viewed	Business (both sensory and motor: sense of taste, movement of tongue for swallowing/gag reflex and phonation)
XI	Spinal Accessory	Some	Marry (motor: movement of the shoulder and some neck muscles)

XII	Hypoglossal	Hops	Money (motor: movement of the tongue)

Assessment of the Cranial Nerves

The cranial nerve exam is an important part of the neurological examination. Cranial nerve assessment can help detect and localize dysfunction of the cerebral cortex or brainstem. Examine the patient fully awake and alert and seated over the edge of the bed or examination table. A patient with decreased level of consciousness (LOC) is unable to participate in a full assessment. For all patients, regardless of LOC or cognition, cranial nerves III (oculomotor; pupillary reflex), V (trigeminal; corneal reflex), IX (glossopharyngeal; gag reflex), and XII (hypoglossal; cough reflex) can and should be tested.

CN I: Olfactory nerve

- Not always tested, especially in acute care settings.
- An upper respiratory infection or COVID-19 is the most frequent cause of dysfunction.
- To test, ask the patient to close their eyes while blocking one nostril with an index finger. Offer the patient something familiar to smell and identify, for example, an orange or lemon peel, coffee, mint extract, or vinegar. Test each nostril separately.
- Smell is intact when the patient reports detection of an odor.

CN II: Optic nerve

- Acuity
  - Use a Snellen chart, or have the patient read something in the room.
  - Assess with patient's vision aid such as glasses or contacts.
- Color
  - Use Ishihara plates to identify patients who are color blind.
- Visual Field (test each eye separately)
  - Ask the patient to cover one eye and look directly at examiner while examiner wiggles one of their fingers in each of the four quadrants. Then, ask the patient to identify which finger is moving.
- Visual Reflexes
  - Place one hand vertically along the patient's nose to block any light from entering the eye which is not being tested and shine a light into each eye observing for pupillary reflexes.

CN III, IV, VI: Oculomotor nerve, trochlear nerve, and abducens

- Extraocular movements are tested by asking the patient to follow a moving target (e.g., examiners finger, pen) to all four quadrants, across the midline, and toward the tip of the nose.
- Look for failure of movement, nystagmus, eyelid drooping (ptosis) and ask the patient if there is any double vision.
- Inspect pupils for size, equality, briskness, and regularity. Observe pupil size with a shined light in a dim room.

CN V: Trigeminal nerve

- Test sensory branches:
  - Lightly touch the face with a piece of cotton followed by a blunt pin in three places on each side of face: around jawline, on cheek, on forehead.
  - Assess corneal reflex by lightly touching each cornea with small piece of cotton. This should cause the patient to blink.
- Test motor branches:
  - Have patient open their mouth against your resistance or simulate chewing gum.

CN VII: Facial nerve

- Test by asking patient to crease up forehead (raise eyebrows), close eyes and keep them closed against resistance, puff out cheeks and reveal teeth. Assess for depressed nasolabial fold. If patient has only lower facial weakness the etiology is peripheral rather than central.
- Assess taste by touching both sides of the patient's tongue with piece of gum or peppermint stick and ask if they can taste it.

CN VIII: Acoustic nerve (also known as vestibulocochlear nerve)

- Test hearing by standing to the side or behind the patient and whisper. Ask the patient to repeat what you whispered.
- The Rinne and Weber tests can also be used to assess hearing and differentiate conductive and sensorineural hearing loss.
  - Rinne test
    - Place sounding tuning fork on patient's mastoid process and then, next to the ear, ask which is louder (normal hearing patient will find the second position the loudest).
  - Weber test
    - Place sounding tuning fork base down in the center of the patient's forehead and ask if it is louder in either ear (should be heard equally in both ears).
- Vestibular function (balance) can be evaluated by performing the Romberg test. The Romberg test has 2 stages.
  - Begin the first stage by asking the patient to stand with shoes off, feet together, arms crossed over chest with hands on opposite shoulders, and eyes open for 30 seconds.
  - In the second stage, ask the patient to put their hands at their sides, and stand still with eyes closed for 30 seconds.
  - If the patient can keep this position with minimal swaying, vestibular function is intact.
  - Be sure to stay near the patient to provide support.
- Assess for the presence of nystagmus, as this may be an indicator of vestibular dysfunction.

CN IX, X: Glossopharyngeal nerve and vagus nerve

- Ask the patient to swallow or attempt to elicit gag reflex with tongue depressor.
- Assess phonation by listening to vocal sounds as the patient speaks.
- Whether the palate elevates symmetrically when the patient says "ah" is noted. If one side is

paretic, the uvula is lifted away from the paretic side.

- In intubated patients, assess for presence and strength of cough/gag reflex via endotracheal suctioning.

CN XI: Spinal Accessory

- Ask the patient to shrug their shoulders and turn their head against your resistance.

CN XII: Hypoglossal

- Have the patient stick out tongue and observe for deviations to either side.

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