Cranial Nerves Exam

YU Yanqin, PhD
Department of Physiology
Zhejiang University School of Medicine
[Purpose]

- To learn how to examine the functions of the 12 pairs of cranial nerves.
- To understand the functions of the 12 pairs of cranial nerves.
The cranial nerves are 12 pairs of nerves that can be seen on the bottom surface of the brain.
Figure 1. 12 pairs of cranial nerves.

I: Olfactory; II: Optic; III-IV-VI: Oculomotor, Trochlear, Abducens; V: Trigeminal; VII: Facial; VIII: Vestibulocochlear; IX-X: Glossopharyngeal, Vagus; XI: Accessory; XII: Hypoglossal
Functions of cranial nerves

- Some of these nerves bring information from the sense organs to the brain --- afferent N.
- Others control muscles --- efferent N.
- Others are connected to glands or internal organs such as the heart and lungs --- automatic N.
Figure 2. The innervation areas of the cranial nerves

I: Olfactory; II: Optic; III-IV-VI: Oculomotor, Trochlear, Abducens; V: Trigeminal; VII: Facial; VIII: Vestibulocochlear; IX-X: Glossopharyngeal, Vagus; XI: Accessory; XII: Hypoglossal
CN I: Olfactory: smell

1. Ask the subject if he has a subjective olfactory problem.
2. Check for rash, deformity of nose.
3. One nostril is occluded while the subject sniffs an unknown substance. Test one nostril with soap, cigarette and toothpaste; ask the subject to point to the correct name on the paper.
4. Test the other nostril, repeat step 3.
There are three main aspects to this nerve: visual acuity, visual fields, and fundi opticus.

1. **Examine visual acuity**: Test each eye separately on the eye chart using an eye cover. If visual acuity is poor, test each eye separately using number of fingers, movement of fingers, reaction to light.

2. **Examine visual fields**: Keep examiner's head level with patient's head. Examine visual fields by confrontation by moving a cotton stick 1 foot from the subject's ears. Or use an arc perimeter to examine visual fields.

3. **Look into the fundi**: The optic fundi should be examined with an ophthalmoscope.
CN III, IV, VI: Oculomotor, Trochlear, Abducens

- **CN III Oculomotor:**
  - Eyelid and eyeball movement

- **CN IV Trochlear:**
  - Innervates superior oblique
  - Turns eye downward and laterally

- **CN VI Abducens:**
  - Turns eye laterally

- Cranial Nerves III, IV and VI innervate the muscles of eye movement and are tested as a unit.
1. **Appearance of eyes:** shape, symmetry, ptosis, nystagmus.

2. **Eyeball movement:** Eye movements are tested by having the subject’s eyes follow the finger of the examiner while keeping the head stationary. Move the finger laterally from side to side, vertically up and down, left up and down, right up and down when lateral gaze is reached. Inspect for nystagmus and limitation in eye movement. Ask if the subject has **double vision**.

3. **Look at pupils:** symmetry, relative size.

4. **Test pupillary light reaction:** Shine light in from the side to gauge pupil's light reaction. Assess both direct and consensual responses. As with the arc test, have the subject place the hand flat extending vertically from the face, between the eyes, to act as a blinder so light can only enter one eye at a time.

5. **Pupillary reaction to convergence and accommodation reflex:** Ask the subject to look at your finger and bring your finger in from a distance of 1 meter to within a few centimeters of the subject’s nose. The eyes should converge and the pupils constrict.
CN V: Trigeminal

- **Functions:**
  - Chewing
  - Face & mouth touch & pain

- **1. Facial sensation:**
  1) Use sterile sharp item on forehead, cheek and jaw.
  2) If abnormal, then test temperature [water-heated/cooled tuning fork], light touch [cotton].
2. **Motor:** Subject opens mouth, clenches teeth.
   1) Palpate temporal, masseter muscles as they clench.
   2) Subject opens mouth; assess the symmetry of the mouth.
3. **Corneal reflex:** patient looks up and away.

   1) Touch cotton wool to the sclera on the other side.

   2) Look for blink in both eyes, ask if subject can sense it.

   3) Repeat on the other side.
4. Test jaw jerk:

1) Examiner places finger on tip of jaw.
2) Use hammer to tap examiner’s finger lightly.
3) Usually nothing happens, or just a slight closure.
**Functions:** controls most facial expressions, secretion of tears & saliva, taste

1. **Muscles of facial expression:**
   1) Inspect for facial droop or asymmetry.
   2) Subject looks up and wrinkles forehead. Look for wrinkling loss.
   3) Feel muscle strength by pushing down on each side.
   4) Subject shuts eyes tightly: compare each side.
   5) Subject grins: compare nasolabial grooves.
   6) Also: frown, show teeth, puff out cheeks.
   7) Corneal reflex already done. See CN V.
2. Check the sense of taste:

The sensory portion (anterior two-thirds) mediates taste from the tongue. The sensation of taste is tested with sodium chloride (salty), sugar (sweet), quinine (bitter) and vinegar (sour). The subject protrudes the tongue, which must be moist, and with a wet applicator, one of these substances is gently rubbed on one side of the tongue. The patient is instructed not to withdraw the tongue until he identifies the substance as sweet, sour, bitter, or salty.
CN VIII: Vestibulocochlear

- **Functions:** hearing; equilibrium sensation

- **Auditory acuity** can be tested crudely by clicking thumb and forefinger together about 2 inches from each ear. If there is a complaint of deafness or if the subject cannot hear the finger click, proceed to the following tests.
1. **Rinne test:** Hold the base of a lightly vibrating high-pitched (512 Hz) tuning fork on the mastoid process until the sound is no longer perceived, then bring the still vibrating fork up close to the ear. Normally—or if the hearing loss is sensorineural—air conduction is greater than bone conduction and the patient will again hear the tone. If there is significant conductive loss, the patient will not be able to hear the air-conducted tone longer than the bone-conducted tone.
2. **Weber test:** Lightly strike a high-pitched (512 Hz) tuning fork and place the handle on the midline of the forehead. If there is conductive loss, the tone will sound louder in the affected ear; if the loss is sensorineural, the tone will be louder in the unaffected ear.
3. **Vestibular function**: Vestibular function needs to be tested only if there are complaints of dizziness or vertigo or evidence of nystagmus.
CN IX, X: Glossopharyngeal, Vagus

- **CN IX Glossopharyngeal:**
  - taste
  - senses carotid blood pressure

- **CN X Vagus:**
  - senses aortic blood pressure
  - slows heart rate
  - stimulates digestive organs
  - taste
Some useful tests for detection of deficiencies in motor function of the palate, pharynx, and larynx are described below. Sensory function needs to be checked if one suspects cranial neuropathy or a brain stem lesion.

1. **Palatal Elevation**
   Ask the patient to say "ah." Look for full and symmetric palatal elevation. If one side is weak, it will fail to elevate and will be pulled toward the strong side.

2. **Gag reflex (afferent IX, efferent X)**
   Gently touch each side of the posterior pharyngeal wall with a cotton swab and compare the vigor of the gag.

3. **Sensory function**
   Lightly touch each side of the soft palate with the tip of a cotton swab.

4. **Voice Quality**
   Listen for hoarseness or "breathiness", suggesting laryngeal weakness.

5. **Taste test** see CN VII.
CN XI: Accessory

Functions:

- Controls trapezius & sternocleidomastoid
- Controls swallowing movements
Trapezius muscle
Sternocleidomastoid
CN XI: Accessory

- **1. Sternocleidomastoid**
  
  Press a hand against the patient's jaw and have the patient rotate the head against resistance. Pressing against the right jaw tests the left sternocleidomastoid and vice versa.

- **2. Trapezius**
  
  Have the patient shrug shoulders against resistance and assess weakness.
CN XII: Hypoglossal

**Function:** controls tongue movements

- 1. Listen to articulation.
- 2. Inspect tongue in mouth for wasting, fasciculations.
Which cranial nerve is the only one that exits the "posterior" side of the brainstem?
- CN IV (Trochlear).

How many cranial nerves are responsible for eye movements?
- Three: CN III (Oculomotor), IV (Trochlear), and VI (Abducens).

What does "abducens" refer to?
- The abducens nerve carries motor impulses to the lateral rectus eye muscle which moves the eye laterally causing abduction of the eye.

Which cranial nerves carry taste information?
- CN VII (Facial), CN IX (Glossopharyngeal) and CN X (Vagus).

What two cranial nerves carry sensory information about blood pressure to the brain?
- CN IX (Glossopharyngeal) and CN X (Vagus).

Which cranial nerve is responsible for pupillary constriction?
- CN III (Oculomotor).