Neurological Assessment

Health Assessment

Objectives

- Describe the anatomy and physiology of the nervous system.
- Develop questions to be used when completing the focused interview.
- Describe the techniques required for assessment of the nervous system.
- Differentiate normal from abnormal findings in physical assessment of the neurologic system.

Neurologic System

- **Complex Integration, Coordination, and Regulation of Body Systems**

Nervous System

- **Central**
- **Peripheral**

Central Nervous System

- **Brain**
- **Spinal cord**

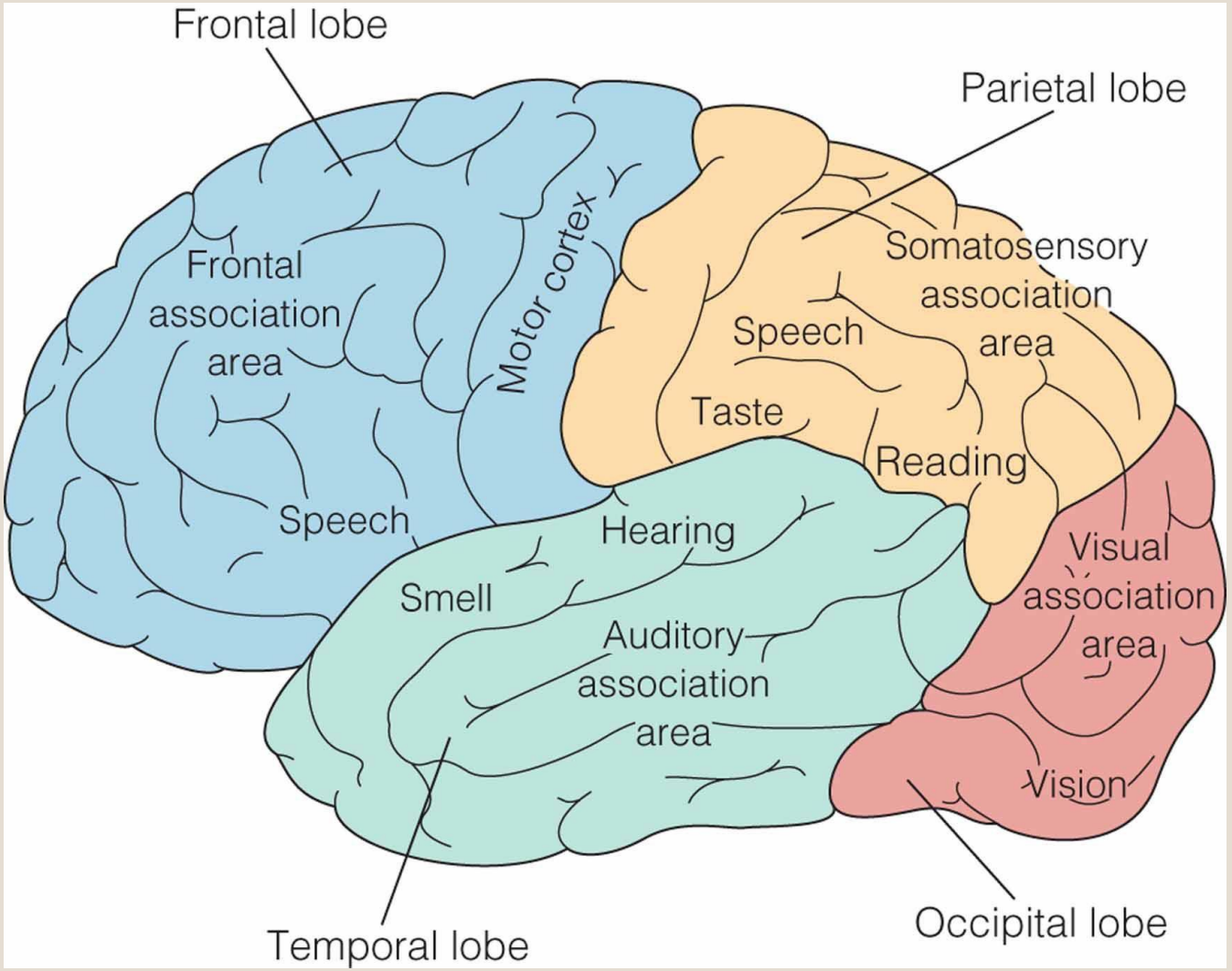
Brain

- Cerebral cortex
  - Frontal
  - Parietal
  - Occipital
  - Temporal
- Diencephalon
  - Thalamus
  - Hypothalamus
  - Epithalamus

Brain

- Cerebellum
- Brain stem
  - Midbrain
  - Pons
  - Medulla oblongata

Regions of the brain



Spinal Cord

- Meninges
- Cerebrospinal fluid
- Vertebrae

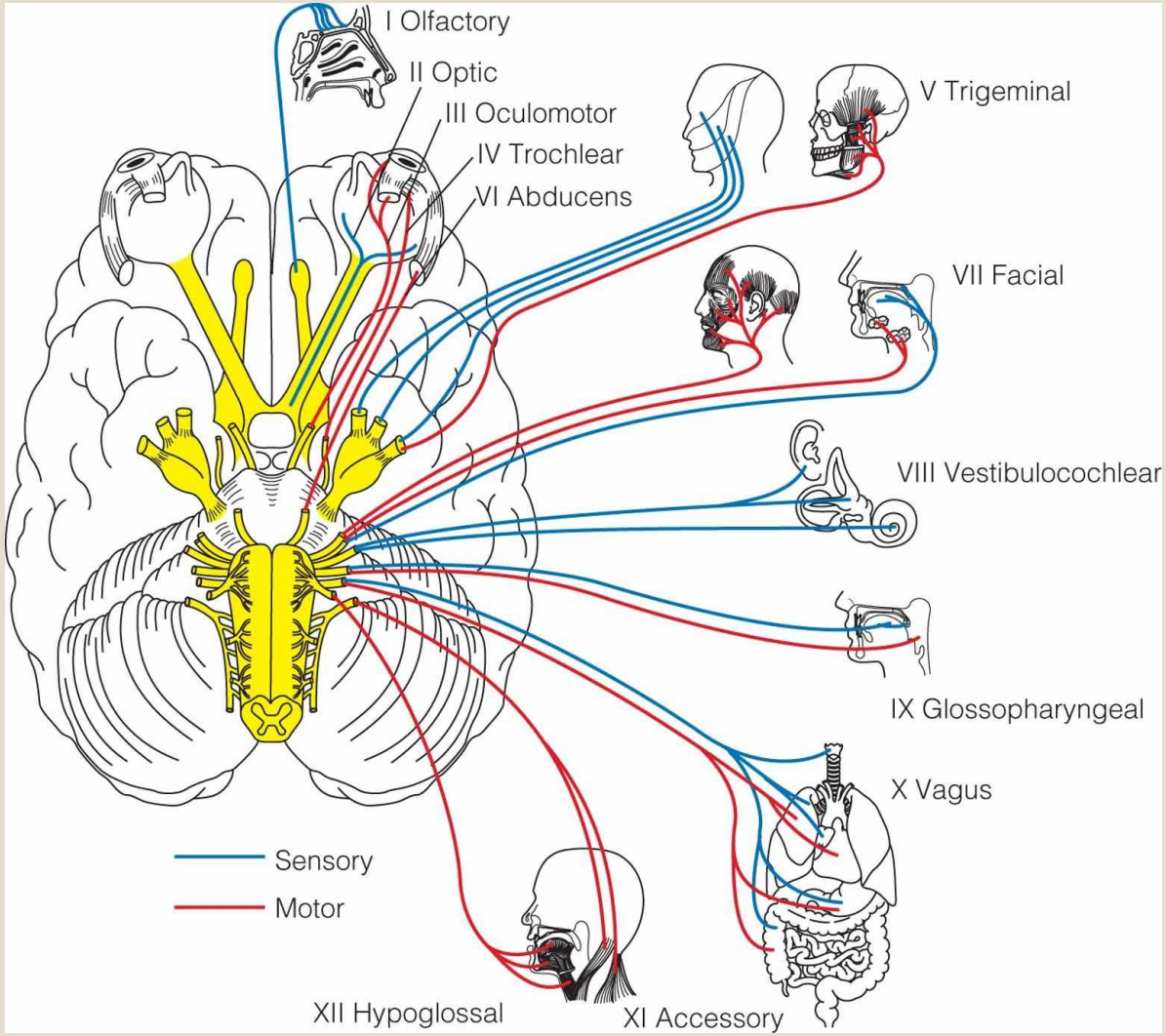
Peripheral Nervous System

- Cranial nerves
- Spinal nerves

12 Pairs of Cranial Nerves

- Originate in the brain
- Control many activities in the body
- Take impulses to and from the brain

Cranial nerves and their target regions. (Sensory nerves are shown in blue; motor nerves, in red.)



Cranial Nerves

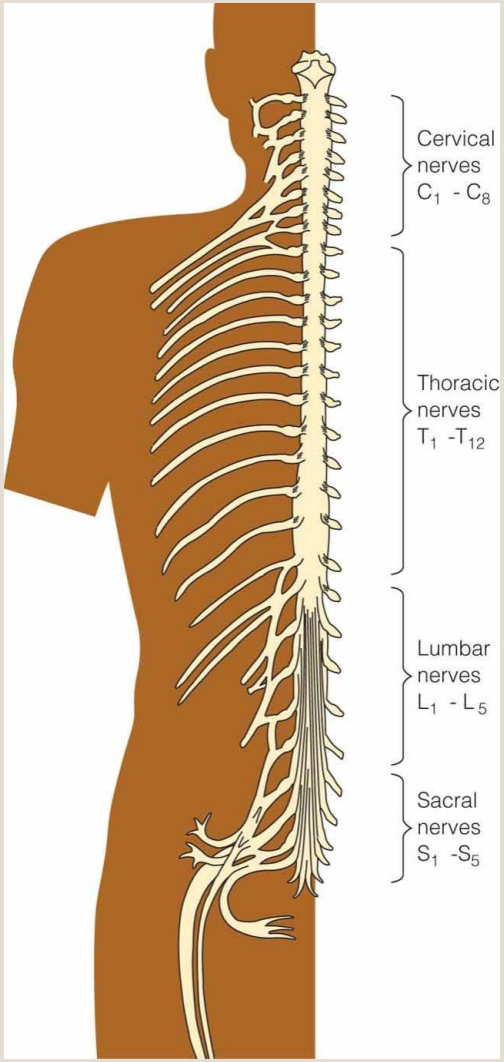
Table 24.1 Cranial Nerves

NAME	NUMBER	FUNCTION	ACTIVITY
Olfactory	I	Sensory	Sense of smell.
Optic	II	Sensory	Vision.
Oculomotor	III	Motor	Pupillary reflex, extrinsic muscle movement of eye.
Trochlear	IV	Motor	Eye-muscle movement.
Trigeminal	V	Mixed	*Ophthalmic branch:* Sensory impulses from scalp, upper eyelid, nose, cornea, and lacrimal gland. *Maxillary branch:* Sensory impulses from lower eyelid, nasal cavity, upper teeth, upper lip, palate. *Mandibular branch:* Sensory impulses from tongue, lower teeth, skin of chin, and lower lip. Motor action includes teeth clenching, movement of mandible.
Abducens	VI	Mixed	Extrinsic muscle movement of eye.
Facial	VII	Mixed	Taste (anterior two thirds of tongue). Facial movements such as smiling, closing of eyes, frowning. Production of tears and salivary stimulation.
Vestibulocochlear	VIII	Sensory	*Vestibular branch:* Sense of balance or equilibrium. *Cochlear branch:* Sense of hearing.
Glossopharyngeal	IX	Mixed	Produces the gag and swallowing reflexes. Taste (posterior third of the tongue).
Vagus	X	Mixed	Innervates muscles of throat and mouth for swallowing and talking. Other branches responsible for pressoreceptors and chemoreceptor activity.
Accessory	XI	Motor	Movement of the trapezius and sternocleidomastoid muscles. Some movement of larynx, pharynx, and soft palate.
Hypoglossal	XII	Motor	Movement of tongue for swallowing, movement of food during chewing, and speech.

Spinal Cord

- 31 pairs of spinal nerves
  - 8 pairs of cervical nerves
  - 12 pairs of thoracic nerves
  - 5 pairs of lumbar nerves
  - 5 pairs of sacral nerves
  - 1 pair of coccygeal nerves
- Dermatome

Spinal nerves



Focused Interview

- Specific questions
  - Illness, infection, or injury
  - Symptoms
  - Pain
  - Behaviors

Physical Assessment of the Neurologic System

- Techniques
  - Inspection
  - Palpation
  - Auscultation of the carotid arteries
  - Sensory and motor function
  - Reflexes

INDICATIONS

Neurological assessment helps to:

- **Identify which component of the neurological system are affected**
- **If possible, determine the precise location of the problem.**
- **Screening for the presence of discrete abnormalities in patients at risk for the development of neurological disorders**

Areas of the Neurologic System Assessment

- Observing mental status, speech, and language
- Observing sensorium, memory, calculation ability, abstract thinking ability, mood, emotional state, perceptions, thought processes, ability to make judgments

HEALTH HISTORY INCLUDES:

- Onset, character, severity, location duration and frequency of signs and symptoms.
- Complaints
- Precipitating, aggravating and relieving factors
- Progression, remission and exacerbation

- **Ask about any associated symptoms (other features of neurological disease):**

- **Headache**
- **Numbness, pins and needles, cold or warmth**
- **Weakness, unsteadiness, stiffness or clumsiness**
- **Nausea or vomiting**
- **Visual disturbance**
- **Altered consciousness**

Past Health History

- **Some neurological problems can present years after a causative event.**
- **Enquire about other medical problems, past and present. These may give clues to the diagnosis. For example:**
  - **A person in atrial fibrillation may be producing multiple tiny emboli.**
  - **There may be diabetes.**
- **Ask about pregnancy, delivery and neonatal health.**

Family History

- **Consider if there may be a genetic basis or predisposition. For example:**
- **Huntingdon's chorea is unusual in that it is a familial disease that does not present until well into adult life.**
- **A family history of, e.g. type 2 diabetes, cerebral aneurysm, neuropathies, epilepsy, migraine or vascular disease may be important.**

Equipment needed

BIG TRAY CONTAINING

- **SHEET FOR COVER PATIENT**
- **GLOVES**
- **Reflex Hammer**
- **128 and 512 (or 1024) Hz Tuning Forks**
- **A Snellen Eye Chart or Pocket Vision Card**
- **Pen Light or Otoscope**
- **Cotton Swabs**

- SPHYGMOMANOMETER
- STETHOSCOPE
- STEEL KIDNEY TRAY
- TEST TUBE-2(ONE FOR COLD WATER AND ONE FOR HOT WATER)
- WATCH
- COMMON PIN OR NEEDLE
- COFFEE POWDER,SUGAR,SALT etc
- PEN/COIN

Tools for Assessment of Mental Status EBP

Table 24.3 Tools for Assessment of Mental Status EBP

TOOL	ASSESSMENT
Mini-Mental State Examination (MMSE)	Cognitive status—conducted via interview
Addenbrooke's Cognitive Examination	Detects early dementia
Confusion Assessment Method (CAM)	Tests for delirium
Telephone Interview for Cognitive Status (TICS)	Similar to MMSE, cognitive function assessed via telephone interview
Cornell Scale for Depression in Dementia	Assessment of behavioral problems
Dementia Symptoms Scale	Assessment of behavioral problems
Psychogeriatric Dependency Rating Scale	Assessment of behavioral problems
Hopkins Competency Assessment Test	Assessment of ability to make decisions about health care
General Health Questionnaire	Assessment of emotional disturbance in those with normal cognitive ability
Hamilton Depression Rating Scale	Assessment of depression in clients with impaired cognition
Short Portable Mental Status Questionnaire (SPMSQ)	Assessment of organic brain deficit

Physical Assessment

A complete neurologic assessment consists of six steps:

- **Mental status exam**
- **Cranial nerve assessment**
- **Motor system assessment**
- **Sensory system assessment**
- **Coordination and Gait**
- **Reflex testing**

Mental Status Exam

- General appearance and behaviour
- Level of consciousness
- body posture
- Dress and hygiene
- speech pattern

CRANIAL NERVES

◦ **O**lfactory (I)	S
◦ **O**ptic (II)	S
◦ **O**cculamotor (III)	M
◦ **T**rochlear (IV)	M
◦ **T**rigemenal (V)	M/S
◦ **A**bducens (VI)	M
◦ **F**acial (VII)	M/S
◦ **V**estibcochlear/Acoustic (VIII)	S
◦ **G**lossopharyngeal (IX)	M/S
◦ **V**agus (X)	M/S
◦ **A**ccessory (XI)	M
◦ **H**ypoglossal (XII)	M

Cranial Nerve I (Olfactory)

- Before testing nerve function, ensure patency of each nostril by occluding in turn and asking patient to sniff
- Once patency is established, ask patient to close eyes
- Occlude one nostril and hold aromatic substance (coffee) beneath nose
- Ask patient to identify substance
- Repeat with other nostril

Cranial Nerve II (Optic)

Use the snellen chart to check/test:

- distant vision

- color

◦*Client should be 20 feet distant from the chart*

◦*Use an object to occlude one eye*

◦*Evaluate the vision one eye at a time*

Cranial Nerves III, IV and VI

=> Test for ocular rotations,

- conjugate movements, nystagmus (involuntary eye movement)
- ** Trochlear Nerve (IV): Pupillary Light Reflex and Ptosis -
- using direct & consensual pupillary reaction to light

Cranial Nerve III (Oculomotor)

- **Assess pupil size and light reflex. A unilaterally dilated pupil with unilateral absent light reflex and/or if the eye will not turn upwards could indicate an internal carotid aneurysm or uncal herniation with increased intracranial pressure**

CN V - Trigeminal Nerve

a. Testing motor function:

- - *Ask* patient to move jaw from side to side against resistance and then clench jaw as you palpate contraction of temporal and masseter muscles, or to bite down on a tongue blade.

CN V - Trigeminal Nerve

b. Testing sensory function:

◦- Ask patient to close eyes

◦- Touch the face with the wisp of cotton

◦- Instruct to tell you when he or she feels sensation on the face.

◦- Repeat the test using sharp and dull stimuli *(toothpick or tongue blade)*

◦- Instruct to say "*Sharp*" or "*Dull*" *(Be random, don't establish a pattern)*

Cranial Nerve V - Trigeminal Nerve

c. Testing corneal reflex:

- Gently touch cornea with cotton wisp.

    o Touching cornea can cause abrasions.

    o Alternative approach is to:

> puff air across cornea with a needless syringe, or

> gently touch eyelash and look for blink reflex

Cranial Nerve VII - Facial Nerve

a. Testing motor function:

- Ask patient to perform these movements: *smile, frown, raise eyebrows, show upper teeth, show lower teeth, puff out cheeks, purse lips, close eyes tightly while nurse tries to open them.*

- Observe face for flaccid paralysis

Cranial Nerve VII - Facial Nerve

b. Testing sensory function:

- - Test taste on anterior two-thirds of tongue for sweet, sour, salty.

◦**Sweet:** Tip of the tongue

◦**Sour:** Sides of back half of tongue

◦**Salty:** Anterior sides and tip of tongue

◦**Bitter:** Back of tongue

Cranial Nerve VIII - Acoustic Nerve

a. Perform Weber and Rinne tests for hearing

b. Perform watch-tick test by holding watch close to patient's ear.

c. Perform Romberg test for balance

- Nurse at the back or side of the pt.

- Instruct client to stand straight, feet together, hands at the side and eyes closed.

Weber Test:

- The Weber test is performed by placing a vibrating 512 Hz tuning fork midline on a patient's forehead or bony dorsum of the nose and asking whether the patient hears the sound on the right, left, or middle.
- Normal hearing will produce equal sound in both ears. Conductive loss will cause the sound to be heard best in the abnormal ear. Sensorineural loss will cause the sound to be heard best in the normal ear.

- Normally, we hear equally in both ears. The Weber test is primarily used to assess patients with unilateral hearing loss and to characterize conductive versus sensorineural loss.Using a 512-Hz tuning fork, strike the tines on your forearm just in front of your elbow and place the stem of the fork on the top of the head or midline of the forehead. Other sites such as the chin or bridge of nose, are sometimes used. The vibrations travel through the skull to the cochlea.
- Ask the patient "Is the sound louder in your right ear, left ear, or the same on both sides?".
- Results:
  - ***Normal hearing*** is confirmed when the sound is heard midline and equally on both sides.
  - ***Unilateral sensorineural hearing loss*** is observed if the patient hears the sound louder (lateralizes) in the unaffected or "good" ear.
  - ***Unilateral conductive hearing loss*** is observed if the patient hears the sound louder (lateralizes) in the affected or "bad" ear.
  - ***Symmetrical conductive hearing loss*** is observed if the patient does not exhibit lateralization.

Rinne Test:

-

Rinne Test Cont..

- Using a 512-Hz tuning fork, strike the tines on your forearm just in front of your elbow and place the stem of the fork on the mastoid bone behind the ear.
- Ask the patient to cover the other ear with their hand and to report when the sound can no longer be heard.
- When the patient can no longer hear the vibration on the mastoid process, move the vibrating tuning fork near the external auditory canal and ask the patient to tell you when the sound can no longer be heard.
- Results:
  - ***Normal*** result is observed when the vibrating fork positioned near the ear is louder and lasts twice as long than when placed on the mastoid bone (i.e., air conduction is better than bone conduction).
  - ***Abnormal*** result is observed when sound is at least equally loud or louder when the fork is placed on the bone compared to when it is held next to the ear (i.e., bone is better than air conduction).

Cranial Nerves IX and X Glossopharyngeal & Vagus Nerves

a. Observe ability to cough, swallow, and talk.

b. *Test motor function:*

- Ask patient to open mouth and say "ah" while you depress the tongue with a tongue blade.

- Observe soft palate and uvula.

- Soft palate and uvula should rise medially.

CN IX and X

c. *Test sensory function of CN IX and motor function of CN X by stimulating gag reflex.*

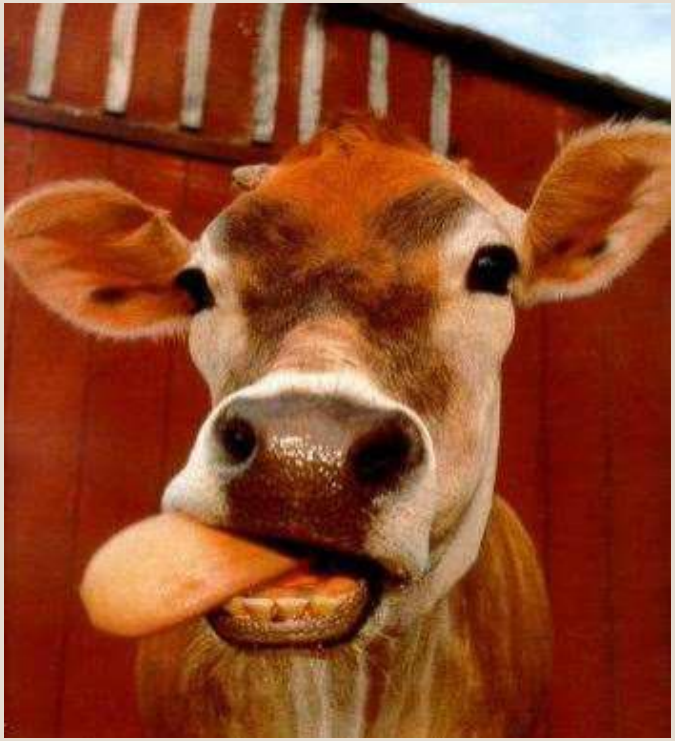
- Tell patient that you are going to touch interior throat
- Then lightly touch tip of tongue blade to posterior pharyngeal wall.
- Observe the pharyngeal movement.
- Ask the client to drink a small amount of water

  *Note the ease & difficulty of swallowing

  *Note quality of the voice or hoarseness when speaking

Cranial Nerve XII (Hypoglossal)

- Ask the patient to stick their tongue straight out of their mouth.
- If there is any suggestion of deviation to one side/weakness, direct them to push the tip of their tongue into either cheek while you provide counter pressure from the outside



The Motor System Examination

- The motor system evaluation is divided into the following: **body positioning, involuntary movements, muscle tone and muscle strength.**
- Note the appearance or muscularity of the muscle (wasted, highly developed, normal).
- Feel the tone of the muscle (flaccid, clonic, normal).
- Test the strength of the muscle group.

Muscle Strength

Grade	Description
0/5	No muscle movement
1/5	Visible muscle movement, but no movement at the joint
2/5	Movement at the joint, but not against gravity
3/5	Movement against gravity, but not against added resistance
4/5	Movement against resistance, but less than normal
5/5	Normal strength

- Starting with the deltoids, ask the patient to raise both their arms in front of them simultaneously as strongly as then can while the examiner provides resistance to this movement. Compare the strength of each arm. The deltoid muscle is innervated by the C5 nerve root via the axillary nerve.

- Test the strength of lower arm flexion by holding the patient's wrist from above an instructing them to "flex their hand up to their shoulder". Provide resistance at the wrist. Repeat and compare to the opposite arm. This tests the biceps muscle. The biceps muscle is innervated by the C5 and C6 nerve roots via the musculocutaneous nerve

- Now have the patient extend their forearm against the examiner's resistance. Make certain that the patient begins their extension from a fully flexed position because this part of the movement is most sensitive to a loss in strength. This tests the triceps. Note any asymmetry in the other arm.
  - The triceps muscle is innervated by the C6 and C7 nerve roots via the radial nerve.

- Test the adduction of the legs by placing your hands on the inner thighs of the patient and asking them to bring both legs together. This tests the adductors of the medial thigh.
  - Adduction of the hip is mediated by the L2, L3 and L4 nerve roots.

- Test the adduction of the legs by placing your hands on the inner thighs of the patient and asking them to bring both legs together. This tests the adductors of the medial thigh.
  - Adduction of the hip is mediated by the L2, L3 and L4 nerve roots.

- Test the abduction of the legs by placing your hands on the outer thighs and asking the patient to move their legs apart. This tests the gluteus maximus and gluteus minimus.
  - Abduction of the hip is mediated by the L4, L5 and S1 nerve roots

- Holding the bottom of the foot, ask the patient to "press down on the gas pedal" as hard as possible. Repeat with the other foot and compare. This tests the gastrocnemius and soleus muscles in the posterior compartment of the lower leg.
  - Ankle plantar flexion is innervated by the S1 and S2 nerve roots via the tibial nerve.

- To complete the motor exam of the lower extremity ask the patient to move the large toe against the examiner's resistance "up towards the patient's face". The extensor halucis longus
  - muscle is almost completely innervated by the L5 nerve root.

The Sensory System Examination

Assessment involves:

- Tactile sensation
- Superficial pain
- Vibration
- Position sense
- **stereognosia**,
- **graphesthesia**, and **extinction**. Diabetes mellitus, thiamine deficiency and neurotoxin damage (e.g. insecticides) are the most common causes of sensory disturbances

PAIN and TEMPERATURE

- - Stimulate skin lightly with sharp and dull ends of toothpick/ paper clip
- - Apply stimuli randomly and ask patient to identify whether sensation is sharp or dull.
- - Touch patient's skin with test tubes filled with hot or cold water.
- - Apply stimuli randomly, and ask patient to identify whether sensation is hot or cold.

Sensory Examination

VIBRATION and PROPRIOCEPTION

- - Place a vibrating tuning fork over a finger joint, and then over a toe joint.
- - Ask patient to tell you when vibration is felt and when it stops.
- - If patient is unable to detect vibration, test proximal areas as well.

Stereognosia

- Test stereognosis by asking the patient to close their eyes and identify the object you place in their hand. Place a coin or pen in their hand. Repeat this with the other hand using a different object
- Astereognosis refers to the inability to recognize objects placed in the hand. Without a corresponding dorsal column system lesion, these abnormalities suggest a lesion in the sensory cortex of the parietal lobe.

Graphesthesia

- Test graphesthesia by asking the patient to close their eyes and identify the number or letter you will write with the back of a pen on their palm. Repeat on the other hand with a different letter or number

Coordination and Gait

Rapid Alternating Movements

- • Ask the patient to strike one hand on the thigh, raise the hand, turn it over, and then strike it back down as fast as possible.

Point-to-Point Movements

- • Ask the patient to touch your index finger and their nose alternately several times. Move your finger about as the patient performs this task.

Romberg:

- • Be prepared to catch the patient if they are unstable.
- • Ask the patient to stand with the feet together and eyes closed for 5-10 seconds without support.
- • The test is said to be positive if the patient becomes unstable (indicating a vestibular or proprioceptive problem).

Perform **Tandem Walking**

- - ask the person to walk a straight line in a heel-to-toe fashion.
- - This decreases the base of support and will accentuate any problem with coordination.

Normal:

- Person can walk straight & stay balanced

Abnormal:

- Crooked line walk
- Widens base to maintain balance
- Staggering, reeling, loss of balance
- An ataxia that did not appear now.

❖***Inability to tandem walk is sensitive for an upper motor neuron lesion, such as multiple sclerosis.***

Gait:

Ask the patient to:

- • Walk across the room, turn and come back
- • Walk heel-to-toe in a straight line
- • Walk on their toes in a straight line
- • Walk on their heels in a straight line
- • Do a shallow knee bend
- • Rise from a sitting position

Examining the Reflexes

- • Motor reflex are involuntary contraction of muscles or muscle groups in response to abrupt stretching near the site of muscle insertion

Technique: *A reflex hammer is used to elicit a deep tendon reflex.*

- • The tendon is struck briskly, and the response is compared with the opposite side of the body (right and left)
- • The response should be equal

Documenting Reflex Findings

◦• Use these grading scales to rate the strength of each reflex in a deep tendon and superficial reflex assessment.

Deep tendon reflex grades

0 absent

+ present but diminished

+ + normal

+ + + increased but not necessarily pathologic

+ + + + hyperactive or clonic (involuntary contraction and relaxation of skeletal muscle)

Superficial reflex grades

0 absent

+ present

ASSESSING REFLEXES

Biceps Reflex

◦- is elicited by striking the biceps tendon of the flexed elbow.

◦- the examiner supports the forearm with one arm while placing the thumb against the tendon and striking the thumb with the reflex hammer.

Normal:

◦■ Flexion at the elbow and contraction of the biceps

Biceps: (C5, C6)

ASSESSING REFLEXES

b. Triceps Reflex

◦- flex pt's arm to 90° angle and positioned in front of the chest

■ Abduct patient's arm and flex it at the elbow.

■ Support the arm with your non-dominant hand.

■ Identify triceps tendon by palpating 2.5 to 5cm (1-2 in) above the elbow

Normal:

◦■ Contraction of triceps with extension at elbow

Triceps: (C6, C7)

ASSESSING REFLEXES

c. Patellar Reflex

- Have patient sit with legs dangling.
- Strike tendon directly below patella.

Normal:

- Contraction of quadriceps with extension of knee.

Patellar: (L3, L4)

ASSESSING REFLEXES

d. Ankle Reflex

◦- Achilles reflex

◦- foot is dorsiflexed at the ankle and the hammer strikes the stretched Achilles tendon

Normal:

◦■ Plantar flexion of foot.

Achilles: (S1, S2)

Superficial Reflexes

Abdominal Reflex

■ Stroke patient's abdomen diagonally from upper and lower quadrants toward umbilicus.

■ Contraction of rectus abdominis. Umbilicus moves toward stimulus.

ASSESSING REFLEXES

BABINSKI REFLEX

■ Stroke sole of patient's foot in an arc from lateral heel to medial ball.

- Fanning of toes when stroked laterally
- Normal in newborn (found until 16 – 24 mos)
- Indicates CNS disease of motor system

Normal:

◦ ■ Flexion of all toes.

Babinski reflex:

Glasgow Coma Scale

GLASGOW COMA SCALE
BEST EYE-OPENING RESPONSE 4 = Spontaneously 3 = To speech 2 = To pain 1 = No response **(Record "C" if eyes closed by swelling)**
BEST MOTOR RESPONSE to painful stimuli 6 = Obeys verbal command 5 = Localizes pain 4 = Flexion—withdrawal 3 = Flexion—abnormal 2 = Extension—abnormal 1 = No response **(Record best upper limb response)**
BEST VERBAL RESPONSE 5 = Oriented × 3 4 = Conversation—confused 3 = Speech—inappropriate 2 = Sounds—incomprehensible 1 = No response **(Record "E" if endotracheal tube in place, "T" if tracheostomy tube in place)**

Neurosurgery Considerations

- Assess for increased intracranial pressure (ICP)
  - Level of consciousness (LOC)
  - Motor function
  - Pupillary response
  - Vital signs
- Following an ICU stay of several days, client will normally be confused about the date.

? Any questions

The END !

GOOD DAY !

and

THANK YOU FOR LISTENING !