

# Neurological examination

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# **A complete neurologic assessment consists of:**

- **1. Level of consciousness and Mental status exam**
- **2. Gait**
- **3. Cranial nerve assessment**
- **4. Motor system assessment**
- **5. Balance and Coordination**
- **6. Reflex testing**
- **7. Sensory system assessment**

# Level of consciousness

## **BOX 17.1** ASSESSMENT OF CONSCIOUSNESS: APPLYING STIMULATION

- *Spontaneous*: Enter room and observe arousal.
- *Normal voice*: State the patient's name; ask him or her to open eyes.
- *Loud voice*: Use loud voice if no response to normal voice.
- *Tactile (touch)*: Touch patient's shoulder or arm lightly.
- *Noxious stimulation (pain)*: Apply nail bed pressure to elicit pain response, telling the patient that you will be applying pressure.

# GLASGOW COMA SCALE

Response	Score
Eye opening	
Opens eyes spontaneously	4
Opens eyes in response to speech	3
Open eyes in response to painful stimulation (eg, endotracheal suctioning)	2
Does not open eyes in response to any stimulation	1
Motor response	
Follows commands	6
Makes localized movement in response to painful stimulation	5
Makes nonpurposeful movement in response to noxious stimulation	4
Flexes upper extremities/extends lower extremities in response to pain	3
Extends all extremities in response to pain	2
Makes no response to noxious stimuli	1
Verbal response	
Is oriented to person, place, and time	5
Converses, may be confused	4
Replies with inappropriate words	3
Makes incomprehensible sounds	2
Makes no response	1

Mild 13-15  
Moderate 9-13  
Severe less than  
8-9

# Mental status exam

## 1. Appearance

- Examination includes evaluation of client's
  - **Posture and position** (erect posture and relaxed position)
  - ,
  - **Body movements (voluntary , coordinated)**
  - **Dress** (appropriate for setting season, age , gender, cloth fit and put on appropriately)
  - **Hygiene and grooming**

## 2. Behavior

- **Facial expression**: the look is appropriate to the situation and changes appropriately with the topic, with comfortable eye contact

- **Speech**

- Articulation is clear and understandable

- **Mood**

The mood should be appropriate to the person's place and condition and should change with topics

### **3. Cognitive and intellectual abilities**

- **Determine the client's orientation to**

Time: day of week

Place: where person lives and present location

Person: examiner and type of work

- ■ Evaluate the client's memory, both recent and remote.

- Recent – Ask the client to repeat a series of numbers or a list of objects.

- Remote – Ask the client to state a fact that is verifiable, such as his birth date

### Judgments

- Evaluate the client's judgment based on his answer to a hypothetical question. (How would the client answer the question, "What would you do if there were a fire in your room?") The response to the question should be logical.



# Cranial Nerves

## Cranial Nerve I - Olfactory Nerve

- 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 I - Olfactory

## Normal:

- Patient is able to identify substance.

*(Bear in mind that some substances may be unfamiliar, especially to children)*

## Abnormal:

- Anosmia - loss of sense of smell.
  - May be inherited and non-pathological: chronic rhinitis, sinusitis, heavy smoking, or cocaine use.
  - It may also indicate cranial nerve damage from facial fractures or head injuries, disorders of base of frontal lobe such as a tumor, or arteriosclerotic changes.

# Cranial Nerve II - Optic Nerve

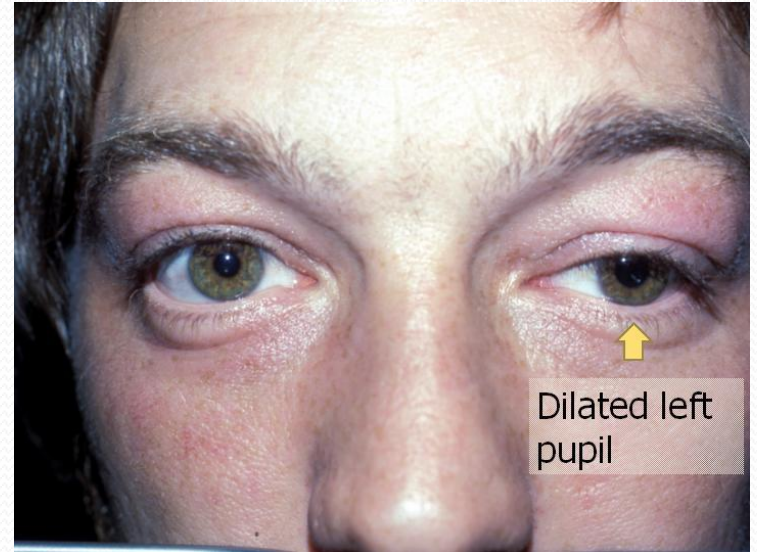
- Visual Acuity (Use the snellen chart to check)
  - Client should be 20 feet distant from the chart*
  - Use an object to occlude one eye*
  - Evaluate the vision one eye at a time*
- Visual Fields (can be tested at the bedside by counting fingers in each quadrant)
- Ophthalmoscope exam



# Cranial Nerves III, IV and VI

CN III Oculomotor: moves eyes in all directions except outward and down & inward opens eyelid; constricts pupil

CN IV Trochlear: moves eyes down and in.....



## Normal:

- Able to read without difficulty
- Visual acuity intact 20/20, both eyes

constriction of pupils in reaction to light, followed by dilation

## Abnormal:

### ■ CN II deficits

- can occur with stroke or brain tumor.

### ■ Changes in pupillary reactions

*Response becomes more sluggish until pupils finally become fixed and dilated.*

# ***CN VI Abducens: moves eyes outward***

## **Abducens Palsy of the Right Eye**

**Affected  
Right Eye**

**Normal  
Left Eye**



**Primary position: right esotropia**



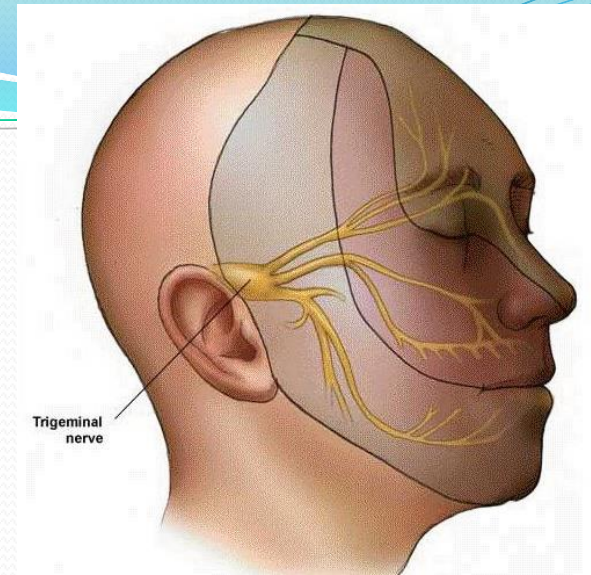
**Left gaze: no deviation**



**Right gaze: left esotropia**



# 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



# 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*”

Testing CN V –  
sensory function





# Cranial Nerve V - Trigeminal Nerve

*c. Testing corneal reflex:*

gently touch eyelash  
and look for blink reflex

Testing corneal reflex

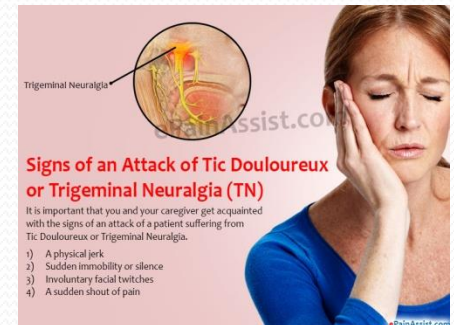


## Normal:

- Full range of motion (ROM) in jaw and 15 strength.
- Patient perceives light touch and superficial pain bilaterally

## Abnormal:

- **Weak or absent contraction unilaterally:**
  - Lesion of nerve, cervical spine, or brainstem
- **Inability to perceive light touch and superficial pain**
  - may indicate peripheral nerve damage.
- **Trigeminal Neuralgia:**
  - Neuralgic pain of CN V caused by the pressure or degeneration of a nerve



- **Corneal reflex test used in patients with decreased LOC**
  - to evaluate integrity of brainstem.

# Cranial Nerve VII - Facial Nerve

## a. *Testing motor function:*

- Ask patient to perform these movements: *raise eyebrows, close eyes tightly while nurse tries to open them. Smile, show puff out cheeks.*

- Observe face for flaccid paralysis



Testing CN VII – motor function

# 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

Testing taste sensation



# CN VII - Facial Nerve

## *Normal:*

- Facial nerve intact
- Able to make faces.
- Taste sensation on anterior tongue intact.
- (Taste decreased in older adults.)

## *Abnormal:*

### Asymmetrical or impaired movement:

- Nerve damage, such as that caused by Bell's palsy or stroke.

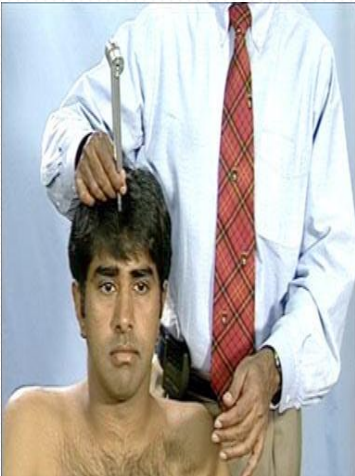


### Impaired taste/loss of taste:

- Damage to facial nerve, chemotherapy or radiation therapy to head and neck.

# Cranial Nerve VIII - Acoustic Nerve

- Perform Weber and Rinne tests for hearing



- 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.



# Cranial Nerve VIII - Acoustic Nerve

## Normal:

- Hearing intact.
- Negative Romberg test.

## Abnormal:

- Hearing loss, balance disturbance, dizziness / vertigo:  
Acoustic nerve damage.  
cerebellum problem or  
phenytoin (Dilantin) toxicity.



# Cranial Nerves IX Glossopharyngeal

Ability to swallow and discriminate between sugar and salt on posterior third of the tongue.

# CN X vagus nerve

Depress the tongue blade in posterior tongue and stimulate the posterior pharynx to elicit gag reflex  
see hoarseness of the voice.



# CN XI - Spinal Accessory Nerve

*Test motor function of shoulder and neck muscles:*

=> Ask patient to shrug shoulders upward against your resistance. (trapezius muscle)

=> Then ask her or him to turn head from side to side against your resistance. (Sternocleidomastoid muscle)



\*\*Observe for symmetry of contraction and muscle strength.

# CN XII - Hypoglossal Nerve

## Hypoglossal Nerve Injury

- Test:
- Ask patient to stick out tongue
- Symptoms of nerve damage:
- When paralyzed, the tongue will point to the damaged side



# Examining the Motor System

- Assessing the patient's ability to flex or extend the extremities against resistance tests muscle strength.
- The evaluation of muscle strength compares the sides of the body with each other

# MUSCLE STRENGTH

- Muscle tone (*tension present in a muscle at rest*) is evaluated by palpation
- Abnormalities in tone include:
  - *Spasticity (increased muscle tone)*
  - *Flaccidity*

British Medical Council  
Method of Scoring

<b>Score</b>	<b>Strength Finding</b>
0	No movement
1	Flicker movements
2	Movement with gravity eliminated
3	Movement against gravity only
4	Full movement against some resistance
5	Full movement against full resistance

# Balance and Coordination

- Cerebellar influence on the motor system is reflected in balance and coordination.
- **Coordination of the hands and extremities** is tested by:
  - Rapid, alternating movements
  - POINT TO POINT TESTING



## a. Rapid Alternating Movements (RAM)

Ask the person to pat the knees with both hands, lift up, turn hands over, and pat the knees with the backs of the hands.

Then ask to do this faster.

### Normal:

- done with equal turning and quick rhythmic pace

### Abnormal:

- Lack of coordination
- *Dysdiadochokinesia*
  - Slow, clumsy, and sloppy response
  - occurs with cerebellar disease



The patient is asked to pronate and supinate the hands as rapid as possible

## b. Finger-to-Finger test

With the persons eyes open, ask that he or she use index finger to touch your finger, then his or her own nose. After a few times move your finger to a different spot.



### Normal:

- Movement is smooth and accurate

### Abnormal:

#### ▪ *Dysmetria*

- clumsy movement with overshooting the mark
- occurs with cerebellar disorder

- Coordination in the lower extremities is tested by **The heel-shin test**
- the patient runs the sole of one foot up and down the shin of the opposite leg
- if cerebellar disease is present, then the test is performed poorly and intention tremor may become pronounced
- **Tremors** are rhythmic, involuntary movements

*=> The presence of these movements suggests cerebellar disease*

# 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.

Grade	Description
0	Absent
1+ or +	Hypoactive
2+ or ++	"Normal"
3+ or +++	Hyperactive without clonus
4+ or ++++	Hyperactive with clonus

## Superficial reflex grades

o 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

# 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





# ASSESSING REFLEXES

## c. Patellar Reflex

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

### Normal:

- Contraction of quadriceps with extension of knee.



# 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.



# ASSESSING REFLEXES

## e. Test for Clonus

- When reflexes are very hyperactive, a phenomenon called ***clonus*** may be elicited
- If a foot is abruptly dorsiflexed, it may continue to “beat” two to three times before it settles into a position of rest
- The presence of clonus always indicates the presence of CNS disease and requires further evaluation

***Normal:***

■ ***No contraction***



# 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.

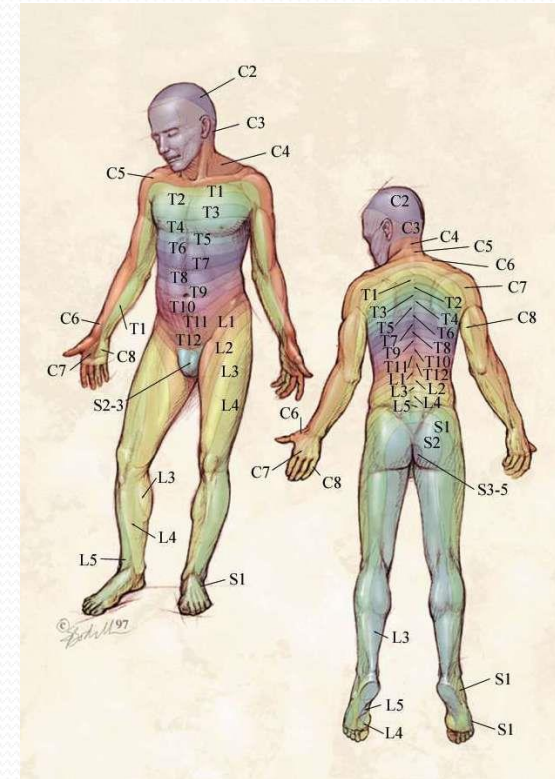


# SENSORY EXAMINATION

- The examiner should be familiar with dermatomes

## Assessment involves:

- Light Touch
- Superficial pain
- Vibration
- Position sense



**\*\* during assessment, pt eyes are kept closed**



# Light Touch

- Brush a light stimulus such as a cotton wisp over patient's skin in several locations, including torso and extremities.

## Normal:

- Identifies areas stimulated by light touch.



## Abnormal:

- **Hypesthesia:** diminished capacity for physical sensation (esp. skin)
- **Hyperesthesia:** Increased sensitivity
- **Paresthesia:** Numbness & tingling
- **Anesthesia:** Loss of sensation.

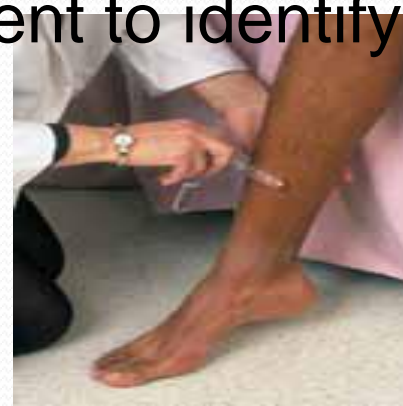


# PAIN and TEMPERATURE

- 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.



## **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.



# Sensory Examination

## Normal:

- Vibratory sensation intact bilaterally in upper and lower extremities.



## Abnormal:

- Diminished/absent vibration sense:
  - Peripheral nerve damage caused by alcoholism, diabetes, or damage to posterior column of spinal cord.