Review Article

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Neurological Assessment: Medical-Surgical Nursing Perspective

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Abstract

Neurological assessment includes a general physical examination pertaining to nervous system and a detailed neurological examination. The purpose of neurological assessment in medical surgical nursing perspective is to establish a nursing diagnosis to guide the nurse in planning and implementing nursing measures to help the patient cope effectively with daily living activities, and monitor progression of the condition and gauge the patient's response to intervention. The frequency of neurological assessments depends on the patients' admitting diagnosis, the presence of any chronic neurological disorders and the current functioning of the patient's neurologic functions. However the information gathered in each assessment must be consistently communicated to all staff involved in the patient care. The content of the neurological assessment will guide nursing teachers and students to proceed the examination stepwise without any confusions and will assist in guiding the pathway to reach the goal.

Keywords: Neurological assessment; Nursing; Neurological conditions.

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Introduction

The empirical role of neurological assessment is to evaluate the health status of a patient with a nervous system disorder or dysfunction. It includes a general physical examination pertaining to nervous system and a detailed neurological examination. It is conducted by either a physician or a nurse practitioner. The purpose of neurological assessment in medical surgical nursing perspective is to establish a nursing diagnosis to guide the nurse in planning and implementing nursing interventions, which will help the patient to cope and adjust with activities of daily living effectively. This is concerned with identifying functional disabilities which interferences with the individual's ability in self-care, to lead an active life, monitor the progress of the condition and assess the patient's response to intervention for which he has been treated.

A complete neurological assessment, intended to determine the existence of neurologic dysfunction on admission or as baseline data which can be further used to compare the progress. The frequency of neurological assessments depends on the patients' admitting diagnosis, the presence of any chronic neurological disorders and the current functioning of the patient's neurologic functions. However the information gathered in each assessment must be consistently communicated to all staff involved in the patient care. In neurological assessment level of consciousness, vital signs, pupillary response, strength and equality of hand grip and movement of hands and determination of ability to sense of touch and pain are the important aspects which needs to be looked for.[1]

Body of Content

Before start up neurological assessment, the nurse should ensure.

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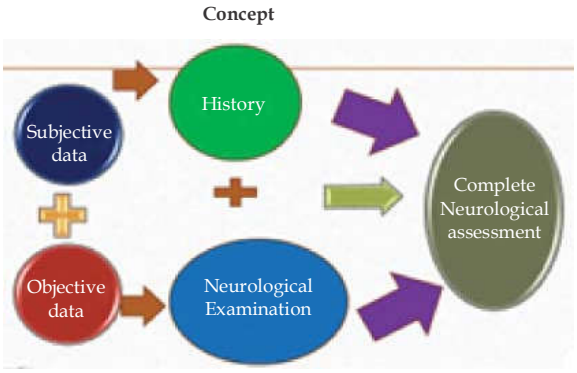
- Evaluation of the patient's vital signs
- If vital signs unstable, which could reduce neurologic responses.
- If vital signs are unstable, wait until the vital signs are relatively stable before conducting the neurological assessment.

Concept of complete neurological assessment

We call it complete neurological assessment when we have collected adequate data from the patient in the form of subjective and objective data. Subjective data comprised relevant history from patient and family members related to disease condition and objective data consists of detail neurological examination of the patient.

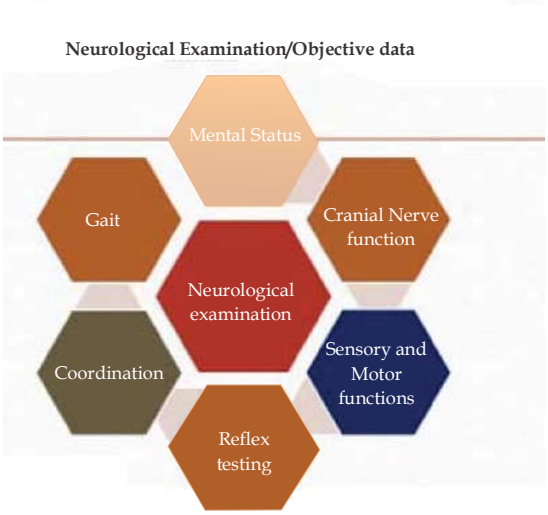


Specific Subjective data: the nurse should collect history relevant to neurological disorders

- Headache: Any unusual frequent or severe headaches?
- Head injury: Ever had any head injury? If yes, any treatment taken?
- Dizziness/Vertigo: Ever feel lightheaded, like feeling faint?
- Seizures: Ever had any convulsions? If yes, its details.
- Tremors: Any shakes or tremors in the hands or face?
- Weakness: Any weakness or problem moving any body part? Is this generalized or local? Does it occur with anything?
- Medication: use of sedatives, opioids, mood stabilizers etc.
- Surgery: any surgery of head, spine or sensory organs in the past.

After collection of history, write the relevant findings pertinent to history, including all the headings.

Neurological Examination/Objective data: to complete neurological examination the major components[2] are illustrated in the figure.



1. **Mental Status Assessment:** the basic componets of mental status examination[3] are

- General appearance and behavior: Level of consciousness, motor activity, body posture, dress hygiene, facial expression, speech pattern
- Cognition Orientation, Memory, Judgement, Problem solving/reasoning, Insight
- Mood/affect: Agitation, anger, Depression etc.

In the view point of medical and surgical disorders the component of general appearance and behavior is an important aspect of mental status examination for neurological patient

Level of consciousness: It is the first assessment if vital signs are normal to identify for changes when there's neurologic injury. It is assessed by Glasgow coma scale[4]. The GCS is a reliable and objective way of recording the initial and subsequent level of consciousness in a person after a brain injury. The summation of the individual score (i.e. E + V + M) classifies the person into stages of consciousness i.e. mild (score = 13–15), moderate (score = 9–12), severe (score = 3–8), and vegetative state (score <3).

The GCS measures the following functions:

Eye Opening (E)

4 = spontaneous

3 = to sound

2 = to pressure

1 = none

NT = not testable (If local injury, edema, or otherwise unable to be assessed, mark "Not testable (NT)"

Verbal Response (V)

5 = orientated

4 = confused

3 = words, but not coherent

2 = sounds, but no words

1 = none

NT = not testable (If intubated or otherwise unable to be assessed, mark "Not testable (NT)"

Motor Response (M)

6 = obeys command

5 = localizing

4 = normal flexion

3 = abnormal flexion

2 = extension

1 = none

NT = not testable (If on sedation/paralysis or unable to be assessed, mark "Not testable (NT)"

Findings after mental status assessment for normal patient the pattern of writing the result:

- The patient is alert, attentive, and oriented to time, place and person with GCS 15
- Speech is clear and fluent with good repetition, comprehension, and naming.
- Hygiene is maintained and maintains normal body posture.

2. **Cranial Nerve Examination:** before performing cranial nerve examination, collect all articles required to test 12 cranial nerves. Proceed systematically from cranial nerve 1, 2 so on, and chart the findings immediately after each cranial nerve examination.

Purpose of cranial nerve examination

- For determining symmetry in general.
- Asymmetrical findings indicate a pathological process.
- Articles needed for cranial nerve examination
- Coffee, lemon
- Snellen chart
- Ophthalmoscope
- Pen Torch
- Cotton
- Pen and paper to write the findings

*Cranial Nerve I (**Olfactory**): Sense of smell*

- Formal assessment of ability to smell is generally omitted, unless there is a specific complaint. If further neededthen first check to make sure that the patient is able to inhale and exhale through the open nostril.
- Tell the patient to close his eyes.
- Present a distinct, common odor (e.g. lemon, coffee) to the open nostrils.
- The patient should be able to correctly identify the odor at approximately 10 cm distance.

*Cranial Nerve II (**Optic**):Sensation of vision*

Visual acuity

- Hold Snellen chart at comfortable reading distance
- Cover one eye and have patient read chart.
- For each eye, record smallest line patient can read.

Interpretation: if the patient can read line 8, their vision is 20/20, which means that the patient can see the same line of letters at 20 feet that a person with normal vision can see at 20 feet.

Visual fields

- Stand directly in front of patient and have patient look you in both eyes.
- Ask the patient to cover his left eye with his left hand and then cover your right eye with your right hand.
- Ask patient to indicate on which side the finger is moving.

Fundoscopy: (Any abnormality detected)

- Dim the lights if possible.
- Have patient focus on distant wall.
- View optic disc using ophthalmoscope
- Note abnormality

Cranial nerve (III, IV&VI) ***Oculomotor, Trochlear and Abducent:*** *eye movement and pupillary reflexes*

Pupillary light reflex

- Ask the patient to look at a distant target and fix to that target
- Shine a pen torch into each eye in turn, bringing the beam in quickly from the lateral side to center
- Note the pupil response: should constrict.
- Bilateral same response is expected.

Visual inspection

- Look at ocular alignment at rest
- 6 cardinal directions of gaze.
- Stand 3-6 feet in front of patient.
- Ask patient to follow your finger with the eyes without moving the head.
- Move your finger in the six directions of eye as shown in the figure and observe whether movements are full in each eye or ant deviation.

Accommodation

Move your finger towards bridge of patient's nose and observe eye movements, whether the eye balls moving in one direction or not.

Cranial nerve ***V Trigeminal:*** *facial sensation, motor function and corneal reflex*

Facial sensation

- Ask the patient to close both the eyes.
- Use sharp end of a cotton swab to test sensation on forehead, cheek, and jaw of each side of face.
- Repeat other side of face too.

Motor function: is checked by the muscles of mastication

- Ask the patient to clench his teeth tight and palpate for the contraction in the temporalis muscle and masseter muscle
- Ask the patient to open his mouth, move his jaw from side to side, then close his mouth

Corneal reflex: Testing of the corneal reflex should not be performed unless sensory impairment suspected, as it is uncomfortable to the patient

- Lightly touch peripheral aspect of cornea from the side with fine wisp of cotton.
- Look for normal blink reaction of both eyes.
- Repeat on other side.
- If response is less than brisk, touch cornea more centrally.

Cranial nerve ***VII Facial****: Facial movement*

- Observe for any facial abnormality during conversation like facial asymmetry, drooping, sagging or smoothing of normal facial creases
- Ask patient to do the following activities and note any difference, weakness on both the sides of face. Observe for asymmetry also.
  a. Smile.
  b. Puff out cheeks with air.
  c. Close both lips tightly and resist your attempt to open them.
  d. Close both eyes and the patient should resist your attempt to open them.
  e. Raise both eyebrows simultaneously.

Cranial nerve ***VIII Acoustic****: hearing*

- Test the hearing by occluding one ear and whispering two words and have the patient repeat them back.
- Repeat this for the other ear.

If patient is not able to hear further assessment done by ENT specialist to rule out pathological condition.

Cranial nerve ***IX & X Glossopharyngeal & Vagus****: palate movement/gag reflex*

- Tell the patient to open his mouth and project his tongue outside, and say "AHHA". As patient say "ahha" the uvula will move up. This infers that the cranial nerve IX is intact**.**
- Ask the patient to swallow and note any difficulty doing so. Observe the quality and sound of the patient's voice. Is it hoarse or not? If the patient can swallow with ease and has no hoarseness while talking, this infers that the cranial nerve X is intact**.**
- Perform gag reflex test by touching the pharynx with the tongue depressor on both the left and then on the right side, observing the normal gag or cough.

Cranial Nerve ***XI Spinal Accessory****. Turning head against resistance*

- Have the patient move head from side to side and up and down and shrug shoulders against resistance.

*Cranial Nerve **XII Hypoglossal:** tongue position and movement*

- Note tongue position at rest in the mouth
- Take out tongue and move it from side to side. Observe strength and rapidity of movements.
- Let the patient push tongue into each cheek while you push from the outside. Note strength.

Findings after cranial nerve assessment for normal patient and the pattern of writing the result

- I can differentiate the smell of coffee/lemon
- II normal visual acuity is 20/20 bilaterally; visual fields full; optic discs sharp with venous pulsations present bilaterally.
- III, IV, VI pupils are 4 mm dilated and reacting to light; extraocular movements present; no ptosis found.
- V facial sensation equal to cotton sensation in all 3 divisions bilaterally.
- VII face symmetric in both sides with normal eye closure and normal smile.
- VIII hearing normal to rubbing fingers or repeating words.
- IX, X palate elevates symmetrically; phonation normal.
- XII tongue midline with good movements and strength.

3. Sensory and Motor functions

Sensory function assessment

Sensory assessment evaluates bilateral pathways of primary sensations. It mostly focuses on pain, temperature (hot and cold), proprioception (i.e. position sense) and light touch.

Articles needed for sensory assessment:

- Gloves
- Needle
- Cotton wisp/brush
- Tuning fork
- 2 bowls, one for warm water and the other for cold water

Components of sensory assessment

- Sensory testing of the face is done by cranial nerves testing which is discussed earlier.
- Sensory testing of the extremities focuses on the two main afferent pathways:
  a. Spinothalamics (detect pain, temperature and crude touch)
  b. Dorsal Columns (detect position, vibratory sensation and light touch)

Spinothalamics

- Ask the patient to close his eyes so that he is not able to get any visual clue regarding articles used to test his sensation.
- Touch the patient's upper limb and lower limb by a needle prick or with cotton wisp or brush and ask patient to differentiate between pain and light touch sensation.
- Touch one body part followed by the corresponding body part on the other side (e.g., the right upper arm with the left upper arm) with the same instrument. In this way the patient the patient is able to compare the sensations and note any asymmetry if present.

Dorsal Columns

Proprioception: This refers to the body's ability to know where it is in space or position check.

Technique

- Tell the patient to close his eyes so that he is not able to get any visual clue.
- With one hand, hold either side of great toe at the interphalangeal (IP) joint. Place your another hand on the lateral and medial aspects of the great toe slightly distal to the IP.
- Bend the toe upwards and downward while informing him of which direction you're moving it.
- Alternately bend the toe up or down without telling the patient in which direction you are moving it.
- They should be able to correctly identify the movement and direction.

Vibratory Sensation: it is done by vibrating turning fork.

- Technique.
- Start at the toes with the patient seated.
- Tell the patient to close his eyes.

- Grasp the tuning fork by the stem and strike the forked ends against the floor, causing it to vibrate.
- Place the stem on top of the interphalangeal joint of the great toe.
- Put a few fingers of your other hand on the bottom-side of this joint
- Ask the patient if they can feel the vibration.
- You should be able to feel the same sensation with your fingers on the bottom side of the joint.
- The patient should be able to determine when the vibration stops, which will correlate with when you are no longer able to feel it transmitted through the joint.
- Repeat in both the legs

Findings after sensory function assessment for normal patient and the pattern of writing the result: Patient is able to detect the sensation of pain, temperature, touch, position sense and vibratory sensation bilaterally equal in hands and legs.

4. Motor function assessment

Motor assessment observes muscle tone, muscle bulk, strength, and abnormal movements.

Articles required for Motor examination

- Gloves (optional)

Components of motor assessment:

Visual inspection.

- Observe muscle bulk, and note any generalized or focal muscle wasting or hypertrophy.
- Look for abnormal movements, e.g., tremor, muscle twitching.

Tone (muscle tension at rest).

- Ask patient to relax at sitting or lying down on bed.
- Flex and extend patient's wrists, elbows, ankles, and knees.
- Look for resistance that is decreased (hypotonia) or increased (throughout range of motion=rigidity; spring-like=spasticity).

Strength: against resistance and gravity

- Grading system:
- As per Medical Research Council scale[5]

Muscle Bulk and Appearance

- Examine the major muscle groups of the upper and lower extremities.
- Fully expose the muscles of both extremities (for comparison)
- The largest and most powerful groups are: biceps, triceps, quadriceps, deltoids, and hamstrings.
- Muscle groups should appear symmetrically developed when compared with their counterparts on the other side of the body.
- There should be no muscle movement when the limb is at rest.

Muscle Tone: before initiating assessment of muscle tone:

- Tell the patient to relax himself and the joints that is to be examined.
- Carefully move the limb thoroughly to its normal full range of motion,
- Each joint to be done separately

Things to look for:

- Normal muscle generates some resistance to movement when a limb is moved passively by an examiner.

Muscle Strength: test each body part separately to compare muscle strength.

Intrinsic muscles of the hand

- Instruct the patient to spread their fingers apart from each other while applying resistance (abduction). Then squeeze them all together, with your fingers placed in between each of their fingers (adduction).

Flexors of the fingers

- Instruct the patient squeezing their hand around two of your fingers and make a tight fist.
- If the grip is normal, you will not be able to pull your fingers out of the grip.

Wrist flexion

- Have the patient try to flex their wrist forward as you provide resistance as shown in the figure.

Wrist extension

- Have the patient try to extend their wrist outward as you provide resistance as shown in the figure.

Elbow Flexion

- First keep the hand parallel to the body and then tell the patient bend hid elbow to ninety degrees while keeping palm directed upwards.
- Then direct him to flex his forearm while you provide resistance on the wrist site.

Elbow Extension

- The main extensor of the forearm is the triceps muscle.
- Tell the patient extend his elbow against resistance while the arm is held out (abducted at the shoulder) from the body at ninety degrees.

Shoulder Adduction

- Tell the patient flex at the elbow while the arm is held out from the body at forty-five degrees as shown in figure.
- Then provide resistance as he try to further adduct at the shoulder.

Shoulder Abduction

- Tell the patient to flex the elbow while the arms is held out from the body at forty-five degrees in sitting position.
- Then provide resistance on the hand as he try to further abduct at the shoulder.

Hip Flexion

- Tell the patient to be seated, keep your hand on top of one thigh and instruct the patient to lift the leg up from the table.

Hip Extension

- Tell the patient lying down in prone position, instruct the patient to lift his leg off the table against resistance placed by you on the leg.

Hip Abduction

- Place your hands on the outer side of either thigh and direct the patient to separate their legs against resistance

Hip Adduction

- Place your hands on the inner aspects of the thighs and repeat the maneuver.

Knee Extension

- Have the seated patient steadily. Keep hand on lower extremity and tell the patient to raise against resistance.

Knee flexion

- Have the patient rest in prone position.
- Then tell the patient to lift his heel up and off the table against resistance provided by you.

Ankle Dorsiflexion

- Direct the patient to lift his toes upwards while you provide resistance with your hand.

Ankle Plantar Flexion

- Tell the patient to keep foot on your hand and try to flex downwards while providing resistance with your hand.

Findings after motor function assessment for normal patient and the pattern of writing the result:

Observe and note the differences found between: Right vs Left, Proximal muscles vs distal, upper extremities vs lower and generalized weakness vs suggestive. There is no pronator drift of out-stretched arms.

- Muscle bulk and tone are normal.
- Strength is full bilaterally

5. Reflex testing

Reflex testing helps to assess functions of both sensory and motor pathways. It gives important insights into the integrity of the nervous system at many different levels.

Principles:

- Tendons connect muscles to bones by crossing a joint.
- When the muscle contracts, the tendon pulls over bone, causing the attached structure to move.

Articles required for reflex testing

- Small Hammers

Technique

- Keep the muscle group in a neutral position (i.e. neither stretched nor contracted) which needs to be tested.
- The tendon attached to the muscles which are to be tested must be clearly identified.
- The extremity should be properly positioned so that the tendon can be easily struck with the reflex hammer.
- Strike the tendon with a single, brisk, stroke. While this is done firmly, it should not elicit pain.

Achilles reflex testing

- Make the patient to be seated, feet dangling over the edge of the exam table.
- Identify the Achilles tendon back of the leg which is cord-like structure running from the heel to the muscles of the calf.
- Support the bottom of the foot with your hand and form a right angle.
- Strike the tendon directly with reflex hammer.
- A normal reflex will cause the foot to plantar flex (i.e. move into your supporting hand).

Patellar reflex testing

- Make the patient to be seated, feet dangling over the edge of the exam table or provide supine position.
- Identify the patellar tendon in front of the knee joint, a thick, broad band of tissue extending down from the lower aspect of the patella.
- For the supine patient, support the back of thigh with your hands such that the knee is flexed. Strike the tendon directly with reflex hammer.
- In the normal reflex, the lower leg will extend towards knee.

Biceps reflex testing

- Make the patient to be seated and relaxed.
- By flexing at the elbow, identify the location of the biceps tendon.
- Position the patients hand in two ways. Anyone can be adopted to examine the biceps.
    - Allow the arm to rest in the patient's lap, forming an angle of slightly more than 90 degrees at the elbow.
    - Support the arm in yours, such that your thumb is resting directly over the biceps tendon (hold their right arm with your right; and vice versa).
- If you are supporting the patient's arm, place your thumb on the tendon and strike on your finger.
- If the arm is not supported by your hand then place your index or middle fingers firmly against the bicep tendon and strike them directly with the hammer.
- Normally the biceps will contract, drawing the lower arm upward directions.

Triceps reflex testing

- Make the patient to be seated and relaxed.
- On the back of the upper arm, identify the triceps tendon.
- Position the patients hand in two ways. Anyone can be adopted to examine the triceps.
    - Tell the patient to pull the arm out from the patient's body, such that it roughly forms a right angle at the shoulder and allow the lower arm dangle directly downward at the elbow.
    - In other way tell the patient place his hand on his hips.
- Strike directly on triceps with hammer.
- The normal reflex leads to extension at the elbow and swing away from the body.
- If the patient's hands are on his hips, the arm will not move but the muscle should shorten vigorously.

Babinski Response

- To check Babinski response use the handle point end of reflex hammer.
- The patient may be either in siting or supine position.
- Apply gentle, steady pressure with the end of the hammer from lateral aspect of the foot towards the heel
- When you reach the ball of the foot, move medially, stroking across this area.
- In the normal patient, the first movement

of the great toe should be downwards (i.e. plantar flexion), then the great toe will dorsiflex and the remainder of the other toes will fan out.

The vigor of contraction[3] is graded on the following scale

0	No evidence of contraction
1+	Decreased, but still present (hypo-reflexic)
2+	Normal
3+	Super-normal (hyper-reflexic)
4+	Clonus: Repetitive shortening of the muscle after a single stimulation

Findings after reflex testing for normal patient and the pattern of writing the result:

Reflexes are 2+ and symmetric at the biceps, triceps, knees, and ankles.

Coordination Testing:

Coordination[2] based on following ideas:

- The cerebellum assists with balance.
- Dysfunction results in a loss of coordination and problems with gait.
- The left cerebellar hemisphere controls the left side of the body and vice versa.

Article: NIL

Finger to nose testing

- In sitting position of the patient, position your index finger in front of the patient.
- Instruct the patient to move his index finger between your finger and his nose.
- Reposition your finger after each touch.
- Then test with the other hand.

Interpretation: The patient should be able to do this in a steady rate of speed, properly trace a straight path, and able to touch the end points accurately.

Rapid Alternating Finger Movements

- Ask the patient to touch the tips of each finger to the thumb of the same hand.
- Test both hands.

Interpretation: The movement should be accurate following sequentially each fingers.

Rapid Alternating Hand Movements

- Direct the patient to touch first the palm and then the dorsal side of one hand repeatedly against their thigh.
- Then test the other hand.

Interpretation: The movement should be performed in a steady rate of speed and accurately.

Heel to Shin Testing

- In lying down or siting position tell the patient to move the heel of one foot up and down along the top of the other shin.
- Then repeat the test in other foot.

Interpretation: while the patient moves he should trace a straight line along the top of the shin and be done with reasonable speed

Findings

- Rapid alternating hand movements and fine finger movements are intact.
- There is no lack of coordination of movement on finger-to-nose and heel-knee-shin.
- There are no abnormal or extraneous movements.

Gait testing

- The normal gait is effortless, with arms swinging easily at the sides.
- Look for disturbances of posture, balance, loss of arm movement, or abnormal leg movements.
- Lack of balance and a wide based gait would suggest a cerebellar disorder.

Article: NIL

Romberg test[6]

- This is a test of balance.
- Ask the patient to stand.
- Have the patient stand in one place with feet together with open eye.
- Later on tell the patient stand with closed eyes.
- It is scored by counting the seconds the patient is able to stand with eyes closed

Results

The Romberg test is positive when the patient is unable to maintain balance with their eyes

closed. Loss of balance suggests impaired proprioception.

Heel to Toe Walking (Tandem gait test of balance)

- Ask the patient to walk in a straight line in straight position, putting the heel of one foot directly in front of the toe of the other and continue in same way.
- This assessment is performed first with eyes open and then with eyes closed.

Findings of gait assessment

- Posture is normal.
- In normal patient the gait is steady with normal steps, arm swing, and turning.
- Heel and toe walking are normal.
- Tandem gait is normal when the patient closes one of her eyes.

Format for Neurological Assessment

Note: Follow above content to carryout neurological assessment

Sl. No	Aspects of examination	Findings	Interpretation
1.	**History pertaining to neurological condition:** • Dizziness/vertigo • Seizures • Tremors • Weakness • Mediation • Surgery		
2.	**Vital signs:** Temperature, Respiration, Pulse, Blood Pressure, • General appearance and behavior: • LOC/GCS • Body posture • Dress hygiene • Speech pattern • Orientation		
4.	Cranial nerve examination • I • II • III,IV,V • VI • VII • VIII • IX,X • XI • XII		
5.	**Sensory assessment:** • Spinothalamic assessment • Dorsal columns: • Proprioception • Vibratory sensation		
6.	**Motor function assessment** • Muscle bulk, appearance, tone • Muscle strength: • Upperlimb:L and R • Lower limb: L and R		

Upper Limb	Intrinsic muscles of hand	Flexors of fingers	Wrist flexion	Wrist extension	Elbow Flexion	Elbow extension	Shoulder Abduction	Shoulder Adduction
Right	Eg. 5							
Left								

Lower Limb	Hip flexion	Hip extension	Hip Abduction	Hip Adduction	Knee flexion	Knee extension	Ankle dorsiflexion	Ankle plantar flexion
Right	Eg. 5							
Left								

7. Reflex testing:

- Achilles reflex
- Patellar reflex
- Biceps reflex
- Triceps reflex
- Babinski response

8. Coordination testing:

- Finger to nose
- Rapid alternating hand movement
- Heel to shin

9. Gait testing:

- Romberg test
- Heel to toe walking

Conclusion

Practicing neurological assessment stepwise will help us to pertain all the data of the patient and help to correlate the data for diagnosing the condition of the patient. Once the abnormalities are identified as a nurse it helps us to plan of the care. Integrating the neurological health history and physical exam takes practice. Critically analyze all the data obtained and synthesize the data.

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