

Class 13 PHE Notes

Nervous system examination

Cranial nerve, Motor function, Sensory function, Dermatomes, Reflexes

1. 12 pairs of cranial nerves – some sensory, some motor and some are mixed
2. 31 pair of spinal nerves – mixed (motor and sensory)
 - a. 8 cervical
 - b. 12 thoracic
 - c. 5 lumbar
 - d. 5 sacral
 - e. 1 coccygeal
3. Dermatomes – area of skin innervated (supplied) by the sensory root of a single spinal nerve.

Common or concerning symptoms (presentation)

1. Headache
2. Dizziness or vertigo
3. Generalized, proximal or distal weakness
4. Numbness, abnormal sensation or loss of sensation
5. Loss of consciousness, syncope, or near syncope
6. Seizures
7. Tremors or any involuntary movements

Questions

1. Is the mental status intact?
2. Are the left and right-side findings the same
3. Findings are asymmetric or abnormal – is it CNS or PNS

Organize your thinking into 5 categories

1. Mental status, speech, language
2. Cranial nerves
3. Motor system
4. Sensory system
5. Reflexes

Motor system

1. Body position
 - a. During movements and rest
 - b. Abnormal positions: monopareses, hemiparesis
2. Involuntary movements
 - a. Tremors, ticks, chorea, fasciculation
 - b. Location, quality, rate, rhythm, amplitude
 - c. Observe in relation to posture, activity, fatigue, emotion, distraction
 - Slow, “pill-rolling” resting tremor – Parkinsonism
3. Muscle bulk
 - a. Size and contours. Do they flat or concave – loss of muscle bulk (wasting atrophy)
 - Atrophy: lower motor neuron pathology. Radiculopathy. Peripheral neuropathy. Hands
 - b. Fasciculation with atrophy and muscle weakness – peripheral motor neuron dysfunction
 - Myopathy: atrophy, but no fasciculation
4. Muscle tone
 - a. It is a slight residual tension (muscle never fully relax)
 - b. The best way to assess the muscle tone by feeling muscle resistance to passive stretch (PROM). Elbow flexion – triceps is stretched and tone is assessed. Taking the arm through all the ranges in shoulder joint and assessing tissue stretch can test what in the muscle – tone
 - Resistance offered to your movement during the passive stretching
 - c. Decreased resistance/loss of tone (Flaccidity)– PNS, spinal cord injury, cerebellum
 - d. Spasticity – increased tone which worsens at the end of range of motion, and resistance increased with more rapid movements. It is velocity dependent.
 - CNS: corticospinal tract
 - e. Rigidity – increased tone that remains the same through entire ROM.
 - CNS: basal ganglia – Parkinson’s disease
5. Test for Pronator drift

- a. Have a patient lift and hold both arms in front of them with palms facing up (supination). Observe for inability to hold and pronation on movement down.
 - b. Specific for corticospinal tract lesions in the contralateral hemisphere
 - c. (Patient closes eye and examiner taps arms, in norm slight drift with immediate bounce back)
6. Muscle strength. At same time are evaluating myotomes, also can name peripheral nerve. Test is done resisting movement. The Grading is from 0 to 5.
- a. Grade 5 – active movement against gravity and full resistance without evidence of fatigue. Normal
 - 5+ or 5-
 - b. Grade 4 – active movement against gravity and some resistance
 - c. Grade 3 – active movement against gravity
 - d. Grade 2 – active movement with gravity eliminated
 - e. Grade 1 – a barely detectable flickering or trace contraction
 - f. Grade 0 – no muscle contraction detected
 - The elbow flexion (C5 and C6, biceps, brachialis (Musculocutaneous) and brachioradialis (Radial n
 - The elbow extension (C6, C7, C8 – triceps (radial nerve))
 - The extension of the wrist (C6, C7, C8, - extensor carpi radialis longus (ECRL), ECRB, ECU
 - Abduction of the hip (L4, L5, S1 – gluteus medius and minimus (Superior gluteal nerve)
 - **Knee extension (L2, L3, L4 – quadriceps (femoral nerve)**
 - Extension of the hips (S1, gluteus maximus)
7. Coordination
- a. Coordination of muscle movement requires the specific areas of nervous system (CNS) to function in an integrative way
 - Motor – muscle strength
 - Sensory – position sense
 - Vestibular system – balance and for coordinating eye, head and body movements
 - Cerebellar – to integrate all of the information – normal, rhythmical, smooth motion

- b. Arms. Strike one hand over the thigh, then supinate and strike with back of the hand on the same place. Slow and then faster.
 - Cerebellar problem: slow, irregular, and clumsy
- c. Tap the distal joint of the thumb with tip of the index finger
- d. Legs. Ask the patient to place the heel on the shin of the opposite leg.
 - Ask the patient to tap the ball of the foot as fast as they can .
- e. Point to point movement
 - Finger to nose: ask the patient to touch your index finger and then touch their nose. Several times. Each time examiner moves the position of index finger around
 - Heel to skin test – in the problem heel overshoots the opposite knee and moves side to side before descent to the skin. Cerebellar problem. If position sense is absent need to look to perform, cannot perform without looking.
- f. Gait
 - Rise from the sitting position without using arms (patient crosses arms over the chest). Proximal weakness – extensor of the hip (gluteus maximus), extensor of the knee (Quadriceps)
 - Ask the patient to walk to and from you.
 - Tandem walking – heel to toe – ataxia – balance issue to walk straight line
 - Walking on toes and heels – plantar flexion, dorsiflexion, and balance
 - Romberg test for position sense. Patient stands feet together. Sensory loss – eye open – ok. Eyes closed falls. In cerebellar disease – no balance eyes closed or open

Sensory System

To evaluate the sensory system, you will test several kinds of sensation:

1. Pain and temperature (spinothalamic tracts)
2. Position and vibration (posterior columns)
3. Light touch (both of these pathways)
4. Discriminative sensations, which rely on some of the above sensations but also involve processing by the sensory cortex

Patterns of Testing.

1. Focus on areas that have numbness or pain, motor or reflex abnormalities suggesting a lesion of the spinal cord or PNS, and trophic changes such as absent or excessive sweating, atrophic skin, or cutaneous ulceration.
2. **Meticulous sensory mapping helps establish the level of a spinal cord lesion, or if a peripheral lesion is localized to a nerve root, a major peripheral nerve, or one of its branches.**

Tips for Detecting Sensory Deficits

1. Compare symmetric areas on the two sides of the body, including the arms, legs, and trunk.
2. **Vary the pace of your testing so that the patient does not merely respond to your repetitive rhythm.**
3. For pain, temperature, and touch sensation, compare distal to proximal areas of the extremities. Scatter the stimuli to sample most of the dermatomes and major peripheral nerves. One suggested pattern is to include:
 - a. both shoulders (C5)
 - b. inner and outer aspects of the forearms (C6 and T1)
 - c. thumbs and little fingers (C6 and C8)
 - d. fronts of both thighs (L3)
 - e. ankle at the medial malleolus (L4)
 - f. dorsum of the foot (L5)
 - g. fifth toes (S1)
 - h. medial aspect of each buttock (S3)
4. For vibration and position sensation, test the fingers and toes first. If these are normal, you may safely assume that more proximal areas are also be normal.

Before each of the following tests, show the patient what you plan to do and explain how you would like the patient to respond. The patient's eyes should be closed during actual testing.

1. Pain.
 - a. Use the stick portion of a broken cotton swab, or other suitable tool. Occasionally, substitute the blunt end for the point. Ask the patient, "Is this

sharp or dull?” or, when making comparisons, “Does this feel the same as this?” Apply the lightest pressure needed for the stimulus to feel sharp; avoid heavy pricks that draw blood. To prevent transmitting any infection, safely discard the device after use. Do not reuse it on another person.

- b. Analgesia refers to absence of pain sensation, hypoalgesia refers to decreased sensitivity to pain, and hyperalgesia refers to increased pain sensitivity.
- 2. Temperature.
 - a. **Testing skin temperature is often omitted if pain sensation is normal.** If there are sensory deficits, use a tuning fork warmed or cooled by running water. Touch the skin and ask the patient to identify “hot” or “cold.”
- 3. Light Touch.
 - a. With a fine wisp of cotton, touch the skin lightly, avoiding pressure. Ask the patient to respond whenever a touch is felt, and to compare one area with another. Avoid testing calloused skin, which is normally relatively insensitive.
 - b. Anesthesia is absence of touch sensation, hypesthesia is decreased sensitivity to touch, and hyperesthesia is increased sensitivity.
- 4. Vibration.
 - a. Use a relatively low-pitched tuning fork of 128 Hz. Tap the prongs on the heel of your hand and place the base firmly over a distal interphalangeal joint of the patient’s finger, then over the interphalangeal joint of the big toe
 - b. Vibration sense is often the first sensation lost in a peripheral neuropathy and increases the likelihood of peripheral neuropathy 16-fold. Causes include diabetes, alcoholism, and certain medications. Posterior column disease, seen in tertiary syphilis or vitamin B12 deficiency, also causes loss of vibration sense.
 - c. Testing vibration sense in the trunk is useful when identifying the level of a cord lesion.
- 5. Proprioception (Joint Position Sense).
 - a. Grasp the patient’s big toe, holding it by its sides between your thumb and index finger, then pull it away from the other toes . This prevents extraneous tactile stimuli from affecting testing. Demonstrate “up” and “down” as you move the patient’s toe clearly upward and downward. Then,

with the patient's eyes closed, ask the patient to say "up" or "down" when moving the large toe in a small arc.

- b. Loss of position sense, like loss of vibration sense, is seen in tertiary syphilis, multiple sclerosis, or B12 deficiency from posterior column damage, and in diabetic neuropathy.

6. Discriminative Sensations.

- a. Several additional techniques test the ability of the sensory cortex to correlate, analyze, and interpret sensations. Because discriminative sensations depend on touch and position sense, they are useful only when these sensations are either intact or only slightly impaired.
 - b. If touch and position sense are normal, decreased or absent, discriminative sensation indicates a lesion in the sensory cortex. Stereognosis, number identification, and two-point discrimination are also impaired in posterior column disease.
7. Screen a patient with stereognosis, and proceed to other methods, if indicated. The patient's eyes should be closed during all these tests.
- a. Stereognosis. Stereognosis refers to the ability to identify an object by feeling it. Place a familiar object such as a coin, paper clip, key, pencil, or cotton ball, in the patient's hand and ask the patient to tell you what it is. Normally a patient will manipulate it skillfully and identify it correctly within 5 seconds. Asking the patient to distinguish "heads" from "tails" on a coin is a sensitive test of stereognosis.
 - b. Astereognosis refers to the inability to recognize objects placed in the hand.
 - c. Number identification (graphesthesia). If arthritis or other conditions prevent the patient from manipulating an object well enough to identify it, test the ability to identify numbers. With the blunt end of a pen or pencil, draw a large number in the patient's palm. Normally, a person can identify most such numbers.
 - The inability to recognize numbers, or graphesthesia, indicates a lesion in the sensory cortex.
 - d. Point localization. Briefly touch a point on the patient's skin. Then ask the patient to open both eyes and point to the place touched. Normally a person can do so accurately.
 - Lesions of the sensory cortex impair the ability to localize points accurately.

- e. Extinction. Touch each arm individually, then simultaneously touch corresponding areas on both arms. Ask where the patient feels your touch with each stimulus. Normally both stimuli are felt. The face and legs can also be tested in the same manner.
- In sensory neglect, stimuli on one side of the body are ignored despite intact primary sensory modalities. With extinction to double simultaneous stimulation, patients will correctly identify a tactile stimulus if the affected side is touched individually but will report touch only on the unaffected side if both sides are touched simultaneously.
- Lesions in the cerebral hemisphere cause extinction of the contralateral side, especially lesions in the right parietal lobe or right basal ganglia.