The Neuro Exam
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• I have no financial disclosures.
Objectives

• Identify normal brain anatomy

• Identify neuro exam techniques

• Identify variations from normal
Nervous System Review

Central Nervous System

- **Brain**
- **Cerebrum** - frontal lobe, parietal lobe, occipital lobe, temporal lobe
- **Diencephalon** – thalamus and hypothalamus
- **Brainstem** – midbrain, pons, medulla
- **Cerebellum**
Nervous System Review

• Central Nervous System
  • Spine
    • 8 cervical vertebrae
    • 12 thoracic vertebrae
    • 5 lumbar vertebrae
    • 5 sacral vertebrae
    • Coccygeal
Nervous System Review

• Peripheral Nervous System
  • Cranial Nerves – 12 pairs
  • Peripheral Nerves – 31 pairs
    • 8 cervical
    • 12 thoracic
    • 5 lumbar
    • 5 sacral
    • 1 coccygeal
Nervous System Review
Nervous System Review
Nervous System Review
Deep Tendon Reflexes

Involuntary stereotypical response that involve at least one afferent (sensory) and one efferent (motor) synapses, across a single synapse.
Assessment

- Mental status, speech, and language
- Cranial nerves
- Motor system
- Sensory system
- Reflexes
Assessment

Three Questions to ask yourself

• Is the mental status intact?

• Are right-sided and left-sided findings symmetric?

• If there is asymmetry or an abnormal finding, does the lesion lie in the central nervous system or peripheral nervous system?
Assessment

• Mental status
  • Level of alertness
  • Appropriate responses
  • Orientation to person, place, and date
## Assessment

<table>
<thead>
<tr>
<th>Nerve Number and Name</th>
<th>Composition</th>
<th>Some Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Olfactory</td>
<td>Sensory only</td>
<td>Olfaction (smell)</td>
</tr>
<tr>
<td>II Optic</td>
<td>Sensory only</td>
<td>Vision</td>
</tr>
<tr>
<td>III Oculomotor</td>
<td>Motor and sensory</td>
<td>Serves muscles of the eye</td>
</tr>
<tr>
<td>IV Trochlear</td>
<td>Motor and sensory</td>
<td>Serves the superior oblique eye muscle</td>
</tr>
<tr>
<td>V Trigeminal</td>
<td>Motor and sensory</td>
<td>Sensory from face and mouth; motor to muscles of mastication (chewing)</td>
</tr>
<tr>
<td>VI Abducens</td>
<td>Motor and sensory</td>
<td>Serves the lateral rectus eye muscle</td>
</tr>
<tr>
<td>VII Facial</td>
<td>Motor and sensory</td>
<td>Serves the muscles of facial expression, lacrimal glands, and salivary glands</td>
</tr>
<tr>
<td>VIII Vestibulocochlear</td>
<td>Sensory only</td>
<td>Equilibrium and hearing</td>
</tr>
<tr>
<td>IX Glossopharyngeal</td>
<td>Motor and sensory</td>
<td>Serves the pharynx (throat) for swallowing, posterior third of tongue, parotid salivary gland</td>
</tr>
<tr>
<td>X Vagus</td>
<td>Motor and sensory</td>
<td>Sensations from visceral (internal) organs, and parasympathetic motor regulation of visceral organs</td>
</tr>
<tr>
<td>XI Accessory</td>
<td>Motor and sensory</td>
<td>Serves muscles that move head, neck, and shoulders</td>
</tr>
<tr>
<td>XII Hypoglossal</td>
<td>Motor and sensory</td>
<td>Serves muscles of the tongue</td>
</tr>
</tbody>
</table>
Cranial Nerve 1 - Olfactory

- Sense of smell
- Shortest cranial nerve
- One of two nerves that do not join with the brainstem.
Assessment

Cranial Nerve II – Optic

- Visual acuity – Snellen eye chart
- Visual fields
Assessment

1. Total blindness of right eye due to complete lesion of right optic nerve
2. Bitemporal hemianopia due to midline chiasmal lesion
3. Right nasal hemianopia due to lesion involving right perichiasmal area
4. Left homonymous hemianopia due to lesion or pressure on right optic tract
5. Left homonymous inferior quadrantanopia due to involvement of lower right optic radiations
6. Left homonymous superior quadrantanopia due to involvement of upper right optic radiations
7. Left homonymous hemianopia due to lesion of right occipital lobe
Assessment

Cranial Nerve II & III – Optic and Oculomotor
Assessment

Cranial Nerve III, IV, VI –
Oculomotor, Trochlear, and Abducens
Assessment

Cranial Nerve V – Trigeminal

• Motor and Sensory of face
• Corneal reflex
Assessment

Cranial Nerve VII – Facial

- Raise both eyebrows
- Frown
- Close eyes tightly
- Bare teeth
- Smile
- Puff out both cheeks
Assessment

- Cranial Nerve VIII - Acoustic
Assessment

• Cranial Nerve IX – glossopharyngeal
• Cranial Nerve X – vagus
Assessment

- Cranial Nerve XI—Spinal Accessory
Assessment

- Cranial Nerve XII – Hypoglossal
Assessment

Muscle Tone

• Inspect muscle bulk – symmetric size and contour
• Inspect muscle tone – assess by feeling muscle’s resistance to passive stretch
• Assess muscle strength – shoulders, elbows, wrists, hand, hips, knees, ankle
Assessment

Muscle Strength

• 0 – No muscular contraction detected
• 1 – A barely detectable flicker or trace of contraction
• 2 – Active movement of the body part with gravity eliminated
• 3 – Active movement against gravity
• 4 – Active movement against gravity and some resistance
• 5 – Normal muscle strength – no fatigue against full resistance
Assessment
Sensory Testing

• Test both distal lower and upper extremities

• Sharp or dull, symmetry

• Wisp of cotton

• Tuning fork

• Proprioception
Assessment
Dermatomes

### MAP KEY

| L1,2,3,4 | Anterior and inner surface of lower limbs |
| L4,5, S1 | Foot |
| L4      | Medial side of great toe |
| S1,2,3,5 | Posterior and outer surface of lower limbs |
| S1      | Lateral margin of foot and little toe |
| S2,3,4  | Perineum |
| T10     | Lateral of umbilicus |
| T12     | Inguinal or groin regions |
| C5      | Clavicles |
| C5, 6, 7 | Lateral parts of upper limbs |
| C6, T1  | Medial sides of the upper limbs |
| C6      | Thumb |
| C6, 7, 8 | Hand |
| C8      | Ring and little fingers |
| T4      | Level of nipples |
Assessment
Deep Tendon Reflexes

- Deep tendon reflexes
  - Biceps reflex C5/C6
  - Brachioradialis reflex C6
  - Triceps reflex C7
  - Patellar reflex L4
  - Achilles tendon S1
- Plantar response
- Reflexes tested in special situations
  - Spinal cord injury
  - Frontal release signs
  - Posturing
- Scale
  - 0 = absent
  - 1+ = hyperactive
  - 2+ = normal
  - 3+ = hyperactive
  - 4+ = hyperactive with clonus
  - 5+ = sustained clonus

Clinical shorthand to summarize reflex findings
Assessment

Babinski Assessment
Assessment
Coordination

• Finger to nose test – observe for smoothness or tremor

• Heel to chin test – observe for smoothness

• Rapid alternating movements
Assessment

• Assess gait – posture, balance, swinging of arms, leg movements

• Romberg – test of position sense
Assessment

Neuro Exam Checklist

1. CN I – assess smell
2. CN II – visual acuity, visual fields
3. CN II & III – pupillary response to light
4. CN III, IV, & VI – extraocular movements
5. CN V – sensory and motor face; corneal reflex
6. CN VII – facial expressions, close eyes
7. CN VIII – hearing
8. CN IX & X – gag, palate rise
Assessment

Neuro Exam Checklist

9. CN XI – neck turn/shoulder shrug
10. CN XII – tongue movement
11. Motor testing – muscle bulk, tone, strength
12. Sensory testing – pain, light touch, proprioception, vibration
13. Reflexes
14. Coordination
15. Gait, Romberg
Case Study 1

• 7 year old female with no PMH who presented in clinic with ataxia and right eye esotropia.

• On exam, she is awake and alert, follows commands. Right CN VI palsy. Decreased right facial sensation. Right facial weakness. Positive decreased facial sensation. Positive Romberg. Left patellar reflexes 4+ with 2-3 beats of clonus in the left foot. All other reflexes 2+. Ataxia noted. Unable to tandem walk. Pupils equal 3-4 mm, react briskly. Nystagmus with upward eye movement.

• Where do you suspect to find this patient’s lesion?
Case Study 1 (cont’d)
Case Study 2

• 12 month old female with 1-2 week history of progressive lethargy, ataxia, and downward gaze deviation.

• Exam: somnolent, irritable, 4 mm equal and reactive bilaterally, Parinaud’s (downward gaze), MAE well, AF full.
Case Study 2 (cont’d)
References

Thank you