Physical Assessment 2

Class 4
• **Class 4:**
• Goals:
  • Learn to match the patient’s symptoms and signs to the location of the neurological deficits
  • Learn to integrate examinations of the cranial nerves and upper extremities into the routine examination of head, neck and thorax while the patient is sitting.
  • Like wise learn to integrate abdominal, lower limb strength, and overall sensation and reflexes when the patient is supine.
• Objectives:
• At the end of the class, the student will be able to:
• Demonstrate examination of the sensory system, including pinprick and light touch, vibration position and two point discrimination
• Demonstrate effective use of the reflex hammer and proper technique for eliciting reflexes, including plantar response and Babinski sign
• Recite the nerve roots for the following reflexes; biceps, triceps, knee and ankle
• Perform muscle testing to evaluate the spinal nerves and recite their respective nerve roots
Evaluating the Neuromuscular system

- Sensory pathways
- Reflex arcs
- Motor output
*Sensory Evaluation*

- Cranial Nerves
- Somatic enervation (light touch, vibration, position sense, two point discrimination, heat/cold, tickle, itch, pain)
Dorsal Column

- Somesthetic cortex (postcentral gyrus)
- Third-order neuron
- Thalamus

Cerebrum

Midbrain

Medial lemniscus
- Gracile nucleus
- Second-order neuron
- Cuneate nucleus

Medulla

- First-order neuron
- Gracile fasciculus
- Cuneate fasciculus

Spinal cord

- Receptors for body movement, limb positions, fine touch discrimination, and pressure
Spinothalamic tract
Receptor types in skin and somatic structures
*Types of Skin enervation mapping*

- Dermatomes: Paths that spinal nerves follow and terminate into the skin
- Named nerve pathways: Follow the path to cutaneous enervation of an entire nerve (multiple sensory fibers to multiple nerve roots involved)
- Referred Pain patterns
- Sclerotomes, myofascial referral, meridian referral
Dermatomes

From ophthalmic division of trigeminal nerve (V<sub>1</sub>)
- Supraorbital nerve
- Supratrochlear nerve
- Palpebral branch of lacrimal nerve
- Infraciliary nerve
- External nasal branch of anterior ethmoidal nerve

From maxillary division of trigeminal nerve (V<sub>2</sub>)
- Intraorbital nerve
- Zygomaticofacial nerve
- Zygomaticotemporal nerve

From mandibular division of trigeminal nerve (V<sub>3</sub>)
- Mental nerve
- Buccal nerve
- Auriculotemporal nerve

Ophthalmic nerve (V<sub>1</sub>)
- Maxillary nerve (V<sub>2</sub>)
- Mandibular nerve (V<sub>3</sub>)

Dorsal rami of cervical spinal nerves
- Auricular branch of vagus nerve (X)
- Medial branches of dorsal rami of cervical spinal nerves
  - Greater occipital nerve (C<sub>2</sub>)
  - 3rd occipital nerve (C<sub>3</sub>)
  - From 4th, 5th, 6th, 7th and 8th nerves in succession below

Branches from cervical plexus
- Lesser occipital nerve (C<sub>2</sub>, 3)
- Great auricular nerve (C<sub>2</sub>, 3)
- Transverse cervical nerve (C<sub>2</sub>, 3)
- Supraclavicular nerves (C<sub>3</sub>, 4)

PLATE 18
HEAD AND NECK
Dermatomes

Schematic demarcation of dermatomes shown as distinct segments. There is actually considerable overlap between any two adjacent dermatomes.

Levels of principal dermatomes:

- **C5**: Clavicles
- **C5, 6, 7**: Lateral parts of upper limbs
- **C8, T1**: Medial sides of upper limbs
- **C6**: Thumb
- **C6, 7, 8**: Hand
- **C8**: Ring and little fingers
- **T4**: Level of nipples
- **T10**: Level of umbilicus
- **T11, 12**: Inguinal or groin regions
- **L1, 2, 3, 4**: Anterior and inner surfaces of lower limbs
- **L4, 5, 6, 7**: Foot
- **L4**: Medial side of great toe
- **S1, 2, 3, 4**: Posterior and outer surfaces of lower limbs
- **S1**: Ring and little toes
- **S2**: Lateral margin of foot and little toe
- **S2, 3, 4**: Perineum
Dermatomes of upper extremity
*Dermatomes of lower extremity*
Named nerve enervation of arm
Thoracic Dermatome Landmarks

**SENsATION**
Test pin prick and light touch in dermatome distribution as for the upper limbs.

Levels to remember:
- T5 – at *nipple*
- T10 – at *umbilicus*
- T12 – at *inguinal ligament.*

**Abdominal reflexes:** T7 – T12 roots. Stroke or lightly scratch the skin towards the umbilicus in each quadrant in turn. Look for abdominal muscle contraction and note if absent or impaired. (N.B. Reflexes may be absent in obesity, after pregnancy, or after abdominal operations.)
• Nerves of the anterior leg
Sciatic Nerve
Tibial Nerve (sciatic nerve)
*Visceral Referred pain patterns*
*Visceral Referred pain patterns*

**Keep in mind:**
- A careful general history and physical examination in backache is of the utmost importance.
- Associated symptoms have differential value.
- Backache may occur in any acute systemic infection.
- Myocardial infarction can also cause back pain.
- Lumbar spasm may accompany the severe pain of certain retroperitoneal diseases (renal tumor, abscess, stone, lymphoma, etc).
- Radicular pain may occur with visceral lesions, as in sciatic radiation due to hypernephroma.
- Just as visceral disease may suggest spinal pathology, so may the radiation of spinal lesions suggest a visceral origin of pain.
- Do not overlook the possibility of rectal and bladder lesions in persistent coccygodynia.
- Check the breasts of all females with back pain. Pain due to metastasis is not infrequently the first sign of a breast lesion.
*Testing

• Use tools you have to assess various skin regions and sensory tracts (Dorsal Column vs. Spinothalamic)
• Dorsal Column (deep touch, visceral pain, vibration)
• Spinothalamic (light touch, tickle, itch, temp., pressure, pain)
*Testing Dorsal Column*

Dorsal Column (deep touch, visceral pain, vibration)

- Test the distal extremities (random or all dermatomes) with pressure and vibration (low frequency tuning fork)

- Ask the patient to close their eyes. Ask tell me if you feel this vibrating. Use one or two as a control test by stopping vibration of the tuning fork before placing on their hand or foot.
*Testing the Spinothalamic Tract*

Spinothalamic (light touch, tickle, itch, temp., pressure, pain)

- Test using pointed object (needle on some reflex hammers), pinwheel, bristle hairs (on some reflex hammers), or two point discriminator (similar to a protractor that uses plastic or hair filaments)
- Test various body regions and/or involved region of patient complaint depending on the detail of the exam you wish to perform
Two point discrimination

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(a) One large receptive field (arrow)
(b) Three small receptive fields (arrows)
****Test the Reflexes****

- Biceps Brachii (C5/6 nerve root level)
- Supinator (C6 nerve root level)
- Triceps Brachii (C7 nerve root level)
- Abdominal Reflexes (T7-12 nerve root level)
- Patellar Ligament Reflex (L4 nerve root level)
- Achille’s Reflex (S1 nerve root level)
- Babinski Reflex (check for it while you are at the foot)
*Biceps Reflex

REFLEXES
Biceps jerk C5, C6 roots. Musculocutaneous nerve

Ensure patient’s arm is relaxed and slightly flexed. Palpate the biceps tendon with the thumb and strike with tendon hammer. Look for elbow flexion and biceps contraction.
*Supinator Reflex

Supinator jerk C6, C7 roots. Radial nerve

Strike the lower end of the radius with the hammer and watch for elbow and finger flexion.
*Triceps Brachii Reflex

**Triceps jerk**

C6, C7, C8 roots.

Radial nerve.

Strike the patient’s elbow a few inches above the olecranon process. Look for elbow extension and triceps contraction.
**Thoracic/Abdominal Reflexes**

**SENSATION**

Test pin prick and light touch in dermatome distribution as for the upper limbs.

Levels to remember:  
- T5 – at *nipple*  
- T10 – at *umbilicus*  
- T12 – at *inguinal ligament*.

**Abdominal reflexes:**  
T7 – T12 roots. Stroke or lightly scratch the skin towards the umbilicus in each quadrant in turn. Look for abdominal muscle contraction and note if absent or impaired. (N.B. Reflexes may be absent in obesity, after pregnancy, or after abdominal operations.)
**Patellar Tendon Reflex**

**REFLEXES**

**Knee jerk:** L2, L3 L4 roots.

Ensure that the patient’s leg is relaxed by resting it over examiner’s arm or by hanging it over the edge of the bed. Tap the patellar tendon with the hammer and observe quadriceps contraction. Note impairment or exaggeration.
*Achille’s Reflex (S1)

Ankle jerk: S1, S2 roots.

Externally rotate the patient’s leg. Hold the foot in slight dorsiflexion. Ensure the foot is relaxed by palpating the tendon of tibialis anterior. If this is taut, then no ankle jerk will be elicited.

Tap the Achilles tendon and watch for calf muscle contraction and plantarflexion.
*Babinski Reflex: Check it while you are at the foot

Reflex enhancement
When reflexes are difficult to elicit, they may be enhanced by asking the patient to clench the teeth or to try to pull clasped hands apart (Jendressik’s manoeuvre).

Plantar response
Check that the big toe is relaxed. Stroke the lateral aspect of the sole and across the ball of the foot. Note the first movement of the big toe. Flexion should occur. Extension due to contraction of extensor hallucis longus (a ‘Babinski’ reflex) indicates an upper motor neuron lesion. This is usually accompanied by synchronous contraction of the knee flexors and tensor fasciae latae.

Elicit Chaddock’s sign by stimulating the lateral border of the foot. The big toe extends with upper motor neuron lesions.

To avoid ambiguity do not touch the innermost aspect of the sole or the toes themselves.
****Motor Output Examination with Manual Muscle testing: Spinal nerve levels (most common)****

Deltoid – C5
Biceps – C5-6
Brachioradialis – C5-6
Triceps, thumb extensor, finger extensors – C7
Finger Flexors – C8
Finger abduction and thumb opposition-T1
Hip flexion-L 1-2
Knee extension – L3 & 4
Hip Abduction – L4 & 5
Ankle dorsiflexion L4
Big toe extension– L5
Knee Flexion – S1
Ankle plantar flexion – S1 & 2
*Deltoid: C5 nerve root

Shoulder abduction

Deltoid: C5, C6 roots
Axillary nerve

Arm (at more than 15° from the vertical) abducts against resistance
*Biceps and Brachioradialis C5/6 and C6 nerve root levels

Elbow flexion

Biceps: C5, C6 roots
Musculocutaneous nerve

Arm flexed against resistance with the hand fully supinated

Brachioradialis: C5, C6 roots
Radial nerve

Arm flexed against resistance with hand in mid-position between pronation and supination
*Triceps and Finger extensors (C7)
Thumb extensor and finger flexor C7 and C8

**Thumb extension – terminal phalanx**
- *Extensor pollicis longus and brevis: C7, C8 roots*
- Posterior interosseous nerve
- Thumb is extended against resistance

**Finger flexion – terminal phalanx**
- *Flexor digitorum profundus I and II: C7, C8 roots*
- Median nerve
- *Flexor digitorum profundus III and IV: C7, C8 roots*
- Ulnar nerve
- Examiner tries to extend patient’s flexed terminal phalanges
*Thumb opposition and Finger abduction (T1)

**Thumb opposition**

*Opponens pollicis: C8, T1 roots. Median nerve*

Patient tries to touch the base of the 5th finger with thumb against resistance

**Finger abduction**

1st *dorsal interosseus: C8, T1 roots. Ulnar nerve*

*Abductor digiti minimi: C8, T1 roots. Ulnar nerve*

Fingers abducted against resistance
**Hip Flexion (L1-2)**

*Hip flexion*

- *Ilio-psoas:* L1, L2, L3 roots. Femoral nerve
- Hip flexed against resistance
*Knee Extension (L3 & 4)

Knee extension

Quadriceps: L2, L3, L4 roots. Femoral nerve

Patient tries to extend knee against resistance
*Foot Dorsiflexion- L4

**Dorsiflexion**

* Tibialis anterior: L4, L5 roots.
  * Deep peroneal nerve

Patient dorsiflexes the ankle against resistance. May have difficulty in walking on heels.
*Hip abduction (L4-5)

**Hip abduction**

*Gluteus medius and minimus and tensor fasciae latae: L4, L5, S1 roots.*

*Superior gluteal nerve*

*Patient lying on back tries to abduct the leg against resistance*
*Big Toe Extension L5

Toe extension

Extensor hallucis longus, extensor digitorum longus: L5, S1 roots.
Deep peroneal nerve

Patient dorsiflexes the toes against resistance
*Knee Flexion – S1

Knee flexion

Hamstrings
L5, S1, S2 roots.
Sciatic nerve

Patient pulls heel towards the buttock and tries to maintain this position against resistance.
Foot Plantar Flexion- S1 & 2

Plantarflexion

Gastrocnemius, soleus:
S1, S2, roots. Tibial nerve.

Patient plantarflexes the ankle against resistance. May have difficulty in walking on toes before weakness can be directly detected
Note:

• The Plantar Flexion and Dorsiflexion tests for muscle strength can also be assessed by having the patient respectively walk balancing on the metatarsal heads (toes/balls of the foot) and walk balancing on their heels.
Upper Motor Neuron Lesion (UMNL) Signs

- Loss of distal extremity strength (ex: weakness in hands)
- Loss of distal extremity dexterity (poor hand control, dropping objects, etc.)
- A Babinski sign
- Increased muscle tone, either
  - Spasticity (clasp knife-like weakness)
  - Rigidity (feels like bending hard plastic...constant resistance through range of motion)
- Hyperreflexia (increased reflex muscle jerk reactions)
- "Clasp-knife phenomena": giveaway weakness at the end range of a muscle test (like closing a Swiss army knife)
Lower Motor Neuron Lesion (UMNL) Signs

- Loss of muscle strength and tone
- Loss of reflexes due to denervation
- Muscle wasting and atrophy
- Denervation hypersensitivity noted by fasciculations (tiny, ongoing contractions of fascicles within a muscle)
Review:

• Be able to perform all reflex and motor tests and know the corresponding spinal nerve levels
• Be able to perform a dermatomal mapping (checking a patient with a pinwheel, light touch, etc.) of the arm and leg
• Check for UMNL or LMNL signs