

CBL

Editing file



Localization

Objectives:

- ★ Master the ability of history-taking of neurological symptoms.
- ★ Importance of asking about functional limitations caused by the deficit.
- ★ Know the importance of detailed neurological examination to pinpoint the deficit.
- ★ Understand the concept of upper and lower motor findings.
- ★ Know the difference between spasticity and rigidity.
- ★ Know the motor (corticospinal) pathways and the effect of their damage
- ★ Discuss the importance of a review of systems and systemic examination, even in pure neurological presentations

Color index:

Original text Females slides Males slides
Doctor's notes Textbook Important Golden notes Extra

Sources:

- BnB
- Kaplan

Sensory tracts

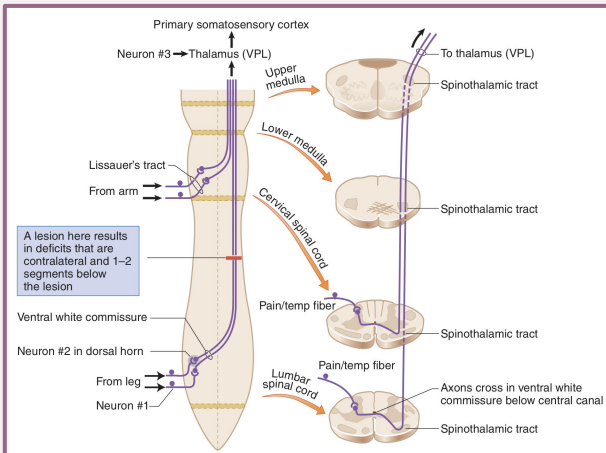
1- Spinothalamic tract

Function: Pain/temperature/crude touch

Neurons:

- 1st:** Spinal root to cord
- 2nd:** Dorsal Horn to Thalamus
- 3rd:** VPL Thalamus to Cortex

Crossing: in the spinal cord at the same level

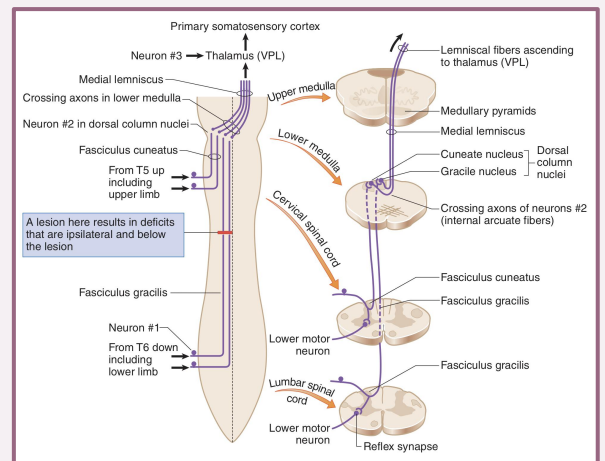


2- Dorsal column (Medial lemniscus)

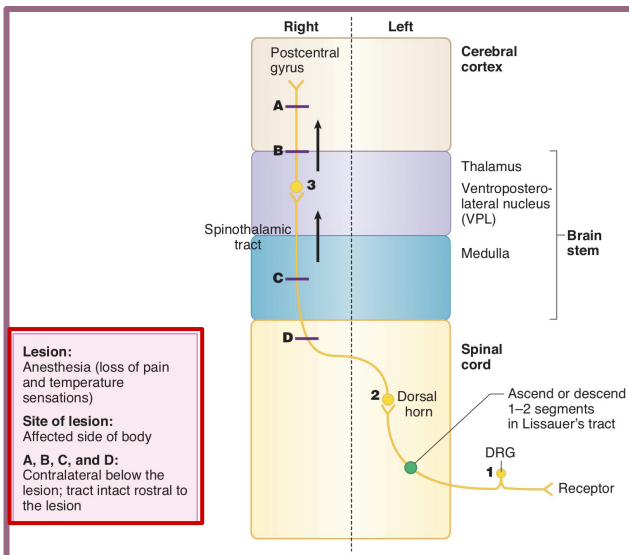
Function: Vibration/proprioception/fine touch

Neurons:

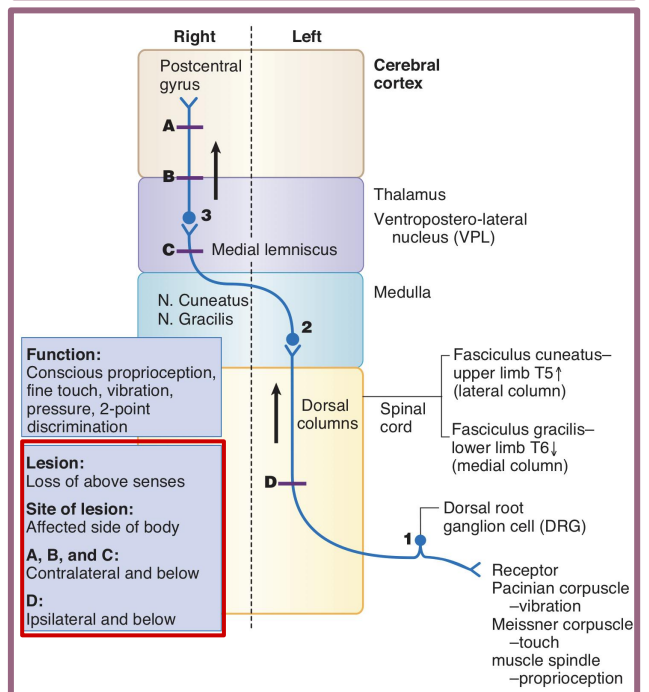
- 1st:** Spinal root up cord
- 2nd:** Gracilis (LL) Cuneatus (UL)
- 3rd:** VPL Thalamus to Cortex



Check the lesions box



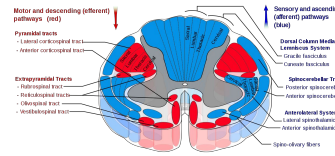
Check the lesions box



Review of basics

Sources:

- BnB
- Kaplan



Note: There are more tracts other than the ones mentioned here, but these 3 tracts (2 sensory, 1 motor) are what you should know.

Motor tract

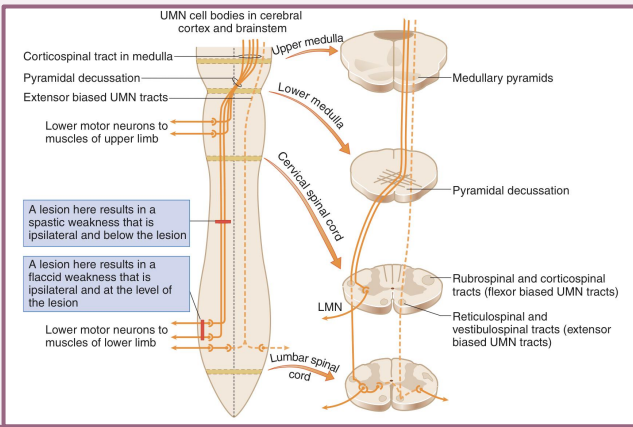
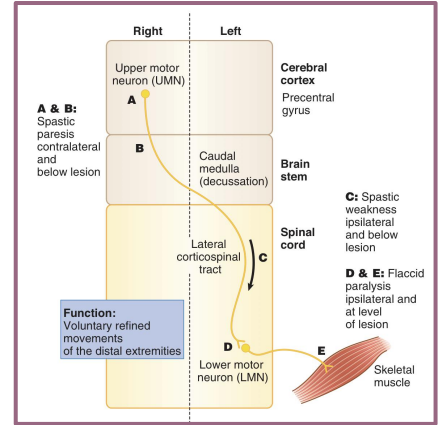
3- Corticospinal tract

Function: Motor
Neurons:

- 1st (UMN):** Cortex to Anterior Horn
- 2nd (LMN):** Anterior Horn to muscle

Note: Decussation at Lower Medulla

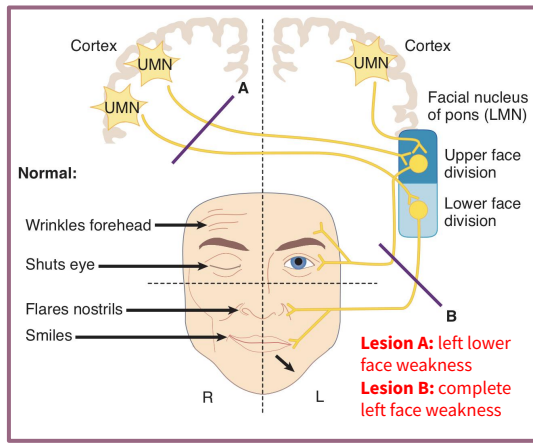
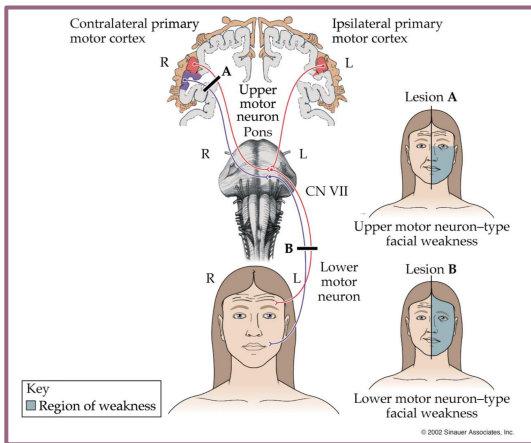
A lesion in the spine will cause ipsilateral weakness (because the fibers already crossed in the medulla) while a brain lesion will cause contralateral weakness



Upper Motor Neuron Lesion*	Lower Motor Neuron Lesion†
Spastic paresis	Flaccid paralysis
Hyperreflexia	Areflexia
Babinski sign present	No Babinski
Increased muscle tone	Fasciculations
Clasp knife reflex	Decreased muscle tone or atonia
Disuse atrophy of muscles	Atrophy of muscle(s)
Decreased speed of voluntary movements	Loss of voluntary movements
Large area of the body involved	Small area of the body affected

*Deficits contralateral or ipsilateral and below the lesion
†Deficits ipsilateral and at the level of lesion

Facial nerve



Summary

KEY

- Lesion
- Sensory/Motor Loss:
 - Vibration and position sense loss
 - Pain and temperature sense loss
 - Motor loss

SPINAL CORD STRUCTURES

- Posterior columns (Vibration and position sense)
- Lateral corticospinal tract (UMN)
- Anterior horn cells (LMN)
- Anterolateral pathways (pain and temperature sense)
- Ventral commissure

(A) Transverse cord lesion (B) Hemisection lesion

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Case study

❖ Mr. Fahad is a 75-year-old man who complains of right-hand weakness and clumsiness.

What information do you need to know?

- **HPI:** he is right handed , **weakness** started gradual, 1 month ago, progressive, worsening over the last 2 weeks. He cannot write properly. He cannot hold objects and cannot open a jar. He is right-handed. Also, **numbness in his right hand and forearm**. No leg weakness. No fluctuation of symptoms. No pain. No headache. No vision changes. No speech changes. No seizures.
- **Systemic review:** positive for weight loss (7 kgs for the last month), poor appetite, chronic cough, and shortness of breath on exertion. No fever.
- **PMH:** hypertension, dyslipidemia, and history of MI (stent).
- **PSH:** none.
- **Medications:** aspirin, atorvastatin, and candesartan.
- **Social:** married. Three kids. He retired math professor.
- **Habits:** ex-heavy smoker (1.5 p/d) for 25 years. Quit 5 years ago after MI. No alcohol. No drugs
- **Family history:** uncle died of colorectal cancer. Father had a stroke and hypertension. Mother is healthy. Otherwise unremarkable.

Based on this history list all possible localizations for the lesion.

Work systematically, exclude one by one:

- Off the top, muscle and NMJ are excluded due to the sensory involvement
- Nerve and root are still possible
- Cord is unlikely (Because if it was transverse, it usually causes weakness in both lower limbs, and if it affects upper spinal cord it usually causes weakness in all 4 limbs) but still on the list (if lesion is small i.e. hemisection)
- Brain stem: excluded due to negative CN involvement in **history** (however, in the examination you should perform CN exam to confirm that, in case the patient did have CN involvement but hasn't noticed it).
- Brain is in
- Thalamus: Excluded, because the pt has motor deficit. Recall that the corticospinal tract doesn't synapse nor pass through the thalamus (Only sensory pathways do)

What will you check on the examination?

- ❖ **General:** looks tired and thin. He was sitting on the bed. No use of accessory muscles. He is alert and oriented to time, place, and person.
- ❖ **V/S:** BP: 142/70. HR : 80 regular, SpO2 96% on R/A. RR is 14 b/m. **Temperature is 36.7** (temp is important for any patient with significant weight loss, for TB or other infection)
- ❖ **Neurological Examination:**
 - **HMF:** normal comprehension, expression, fluency, repetition, and naming. Normal 5-word registration and recall after 5-minutes.
 - **Cranial nerve examination**
 - Normal fundus, fields, and pupils.
 - **Mild flattening of the nasolabial fold on the right side (UMN CN VII lesion)**

	Deltoid	Biceps	Triceps	Wrist extension	W. flexion	Finger extension	Finger flexion
R	4+	5	4+	4	4	3	3
L	5	5	5	5	5	5	5

Case study (cont.)

	Hip Flexion	Hip adduction	Hip abduction	Hip extension	Knee flexion	Knee extension	ADF	AFP
R	5	5	5	5	5	5	5	5
L	5	5	5	5	5	5	5	5

- ❖ **Muscle tone: spastic** in the right arm and leg.
- ❖ **DTRs:** +3 in the right biceps and right brachioradialis. +2 everywhere else.
- ❖ **Babinski sign present in the right and absent on the left.**
- ❖ **Cerebellar:** normal.
- ❖ **Sensory examination: reduced** pinprick, temperature, and vibration perception over the right arm and hand. Otherwise, normal.
- ❖ **Gait examination:** normal.
- ❖ **Chest, heart, abdomen, and skin:** within normal apart from stony dullness and reduced air entry over the right lung base. No lymphadenopathy
 - Why do it? **Chest examination should be performed** to examine the lung for any masses (patient is an ex-heavy smoker, what he has could be a metastatic brain lesion)



Note the arm is adducted and flexed, and the wrist is flexed (bc **extensors are weaker than flexors in UL in case of UMNL**)
 Note that his leg is extended (Bc **flexors are weaker than extensors in LL in case of UMNL**)

Based on the previous findings, where is the abnormality in the nervous system? Explain why?

- Patient has spasticity, positive babinski and hyperreflexia which indicates that there's an **UMN lesion**. So, with this info we can exclude any lesion at the level of the AHC and after. Now, is the lesion in the spinal cord, brainstem or cerebral cortex? Given the signs of the UMNL of the corticospinal tract and UMNL of the facial nerve, it has to be above the pons, bc the nucleus of the facial nerve is at the pons (any lesion at the level of the nucleus and below is considered a LMNL). Furthermore, given the patient's sensory deficit (reduced pinprick, temperature and vibration perception), the sensory tracts must be involved.
Note: babinski is much more important than hyperreflexia, because in cases where hyperreflexia is bilateral, it could be normal. But babinski is 100% pathological (lesion in brain, brain stem or spinal cord (A lesion in the spinal cord will cause loss of LMN at the level of the lesion and UMN loss below it))

What site would cause all these deficits?

- The only place that could cause this is the cerebral cortex (the motor and somatosensory cortices)

Could his weakness be caused by a spinal cord tumor?

- No, for 2 reasons:
 - UMN of facial nerve is involved (So, it has to be above the pons)
 - All the sensory and motor deficits are at the same side. If it was a spinal cord lesion then there will be an ipsilateral motor loss (corticospinal tract), an ipsilateral loss of vibration and proprioception (Dorsal column) and contralateral loss of pain and temperature (Spinothalamic tract), there would also be an ipsilateral LMN involvement at the level of the lesion, which is not the case here bc all deficits are at the same side.

Could his weakness be caused by a slipped cervical disc or a brachial plexus lesion?

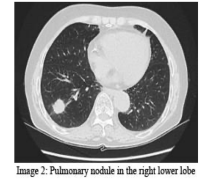
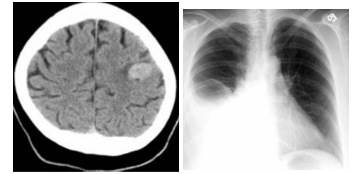
- No, because these will cause LMN signs

Spinal cord tumor	Lower motor neuron signs at the level Sensory level Upper motor neuron signs below the level of the lesion
Disc (root)	Radicular pain, LMN signs, weakness & sensory loss in the distribution of the involved root
Plexus	LMN signs, weakness & sensory loss in the distribution of the involved plexus

Case study (cont.)

How will you investigate this patient?

- **Imaging**
 - See the CT pic, what are the possible causes of this lesion?
 - Metastasis, hemorrhage (amyloid),
 - This patient has likely had metastasis from a primary lung tumor.



Would you change your investigations if his biceps and BR reflexes are absent and muscle tone is low on the right?

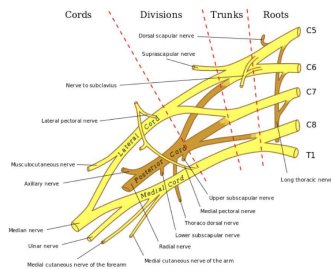
- MRI cervical +/- brachial plexus MRI
- NCS/EMG

How would you investigate if his symptoms and examination findings occur in both hands and his facial nerve was normal?

- Cervical MRI
- NCS/EMG

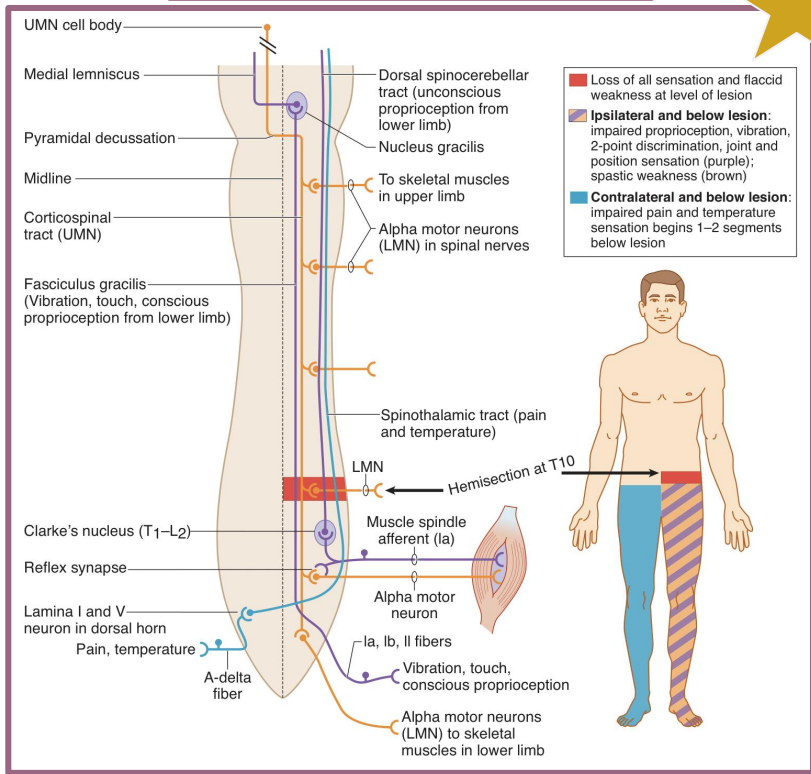
TABLE 3.6 Deep Tendon Reflexes

REFLEX	MAIN SPINAL NERVE ROOTS INVOLVED
Biceps	C5, C6
Brachioradialis	C6
Triceps	C7
Patellar	L4
Achilles tendon	S1



	Myopathy	Neuropathy
Weakness	Proximal	Distal
Sensory	Normal	Impaired
Reflexes	Normal	Decreased
Fasciculations	Absent	May be present

Brown-Séquard Syndrome (Hemisection)



Transverse spinal cord lesion

Disrupt all motor and sensory pathways at and below the level of the lesion. When a patient comes with a bilateral progressive weakness and loss of sensation in the lower limb, it is important to think of transverse spinal cord lesion and investigate urgently & accordingly. Because any delay in the diagnosis may lead to irreversible damage that could make the patient wheelchair-bound forever. Typically, a patient might tell you that they feel as if a "belt" is around a certain level in the trunk, where they are normal above it and numb and weak below it, or you could detect it through examination.

THANKS!!

This lecture was done by:

- Mashal AbaAlkhail
- Raghad ALKhashan



Females co-leaders:

Raghad ALKhashan
Amirah Aldakhilallah

Males co-leaders:

Mashal AbaAlkhail
Nawaf Albhijan

*Send us your feedback:
We are all ears!*

