Upper & Lower Motor Neurons Lesions

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- Important
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Based on Females' Slides

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Contents

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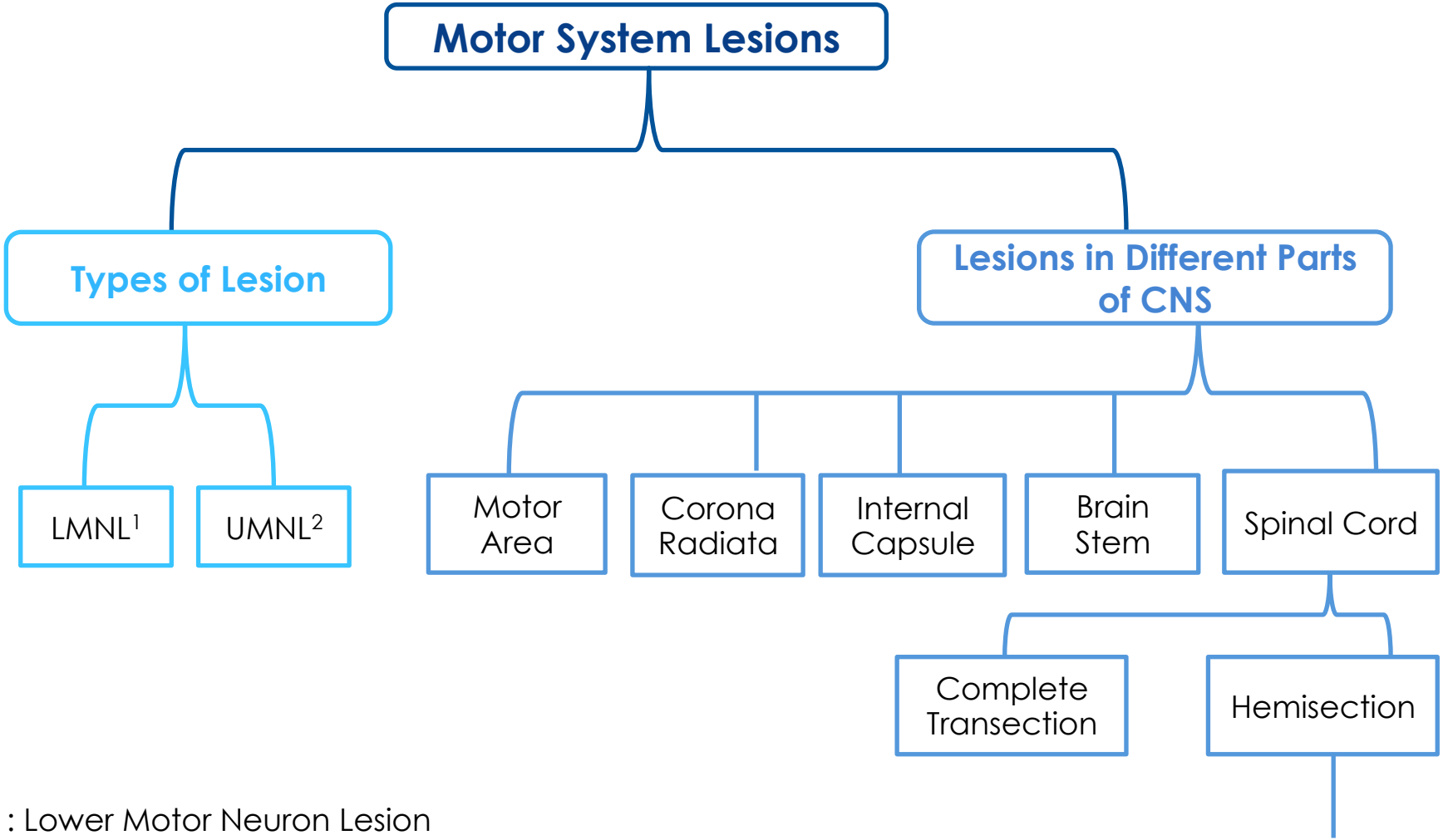
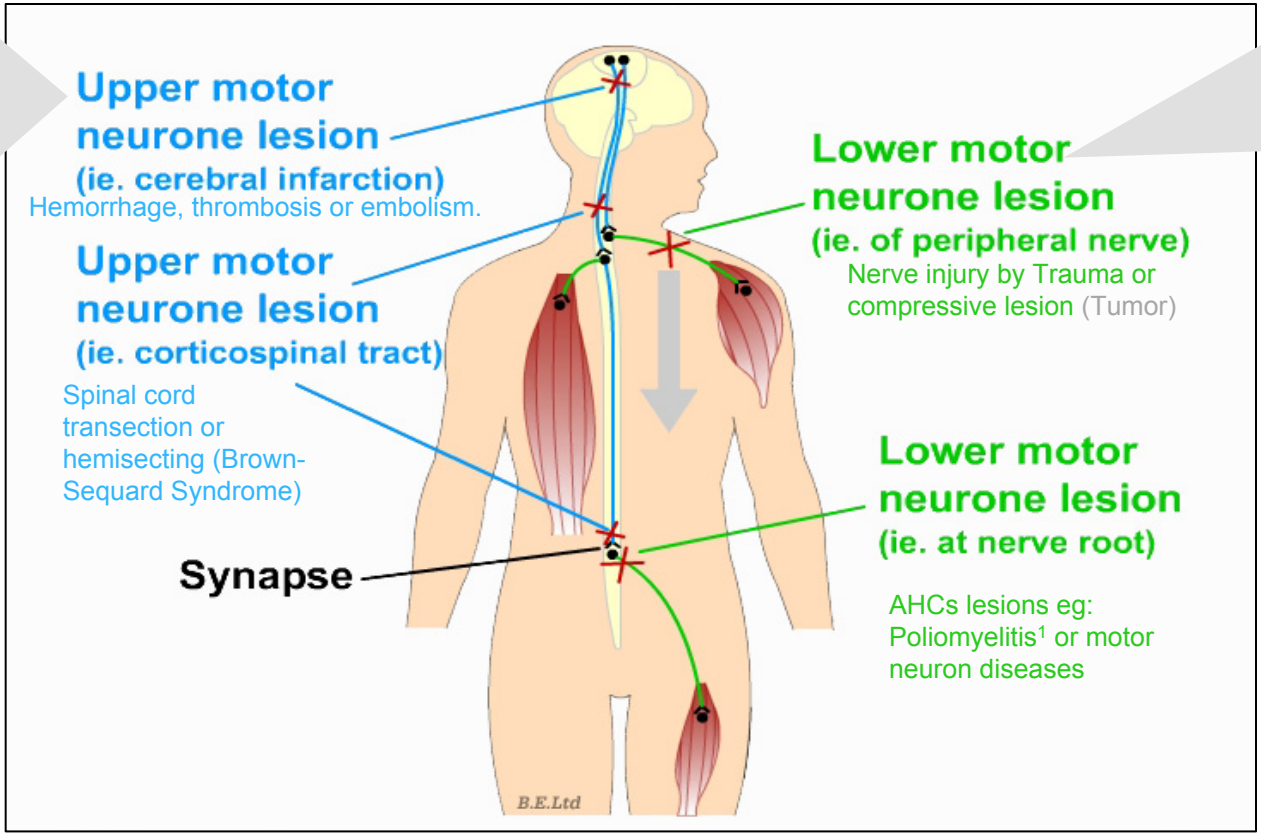


1: Lower Motor Neuron Lesion
2: Upper Motor Neuron Lesion

Mind Map

Upper & Lower Motor Neurons Lesions Causes

Are motor neurons that originate either in the motor region of the **cerebral cortex** or in the brain stem and carry motor information down to the lower motor neurons.



Are motor neurons come out of CNS, they're **connected to neuromuscular junction** and they're the final common pathways of motor system. (AHCs or Brainstem nuclei)

1: Poliomyelitis is a crippling disease that results from infection of poliovirus, it can multiply in specialized cells in the intestines and enter the blood stream to invade the central nervous system, where it spreads along nerve fibers. When it multiplies in the nervous system, the virus can destroy nerve cells (motor neurons) which activate skeletal muscles.

Upper & Lower Motor Neurons Lesions

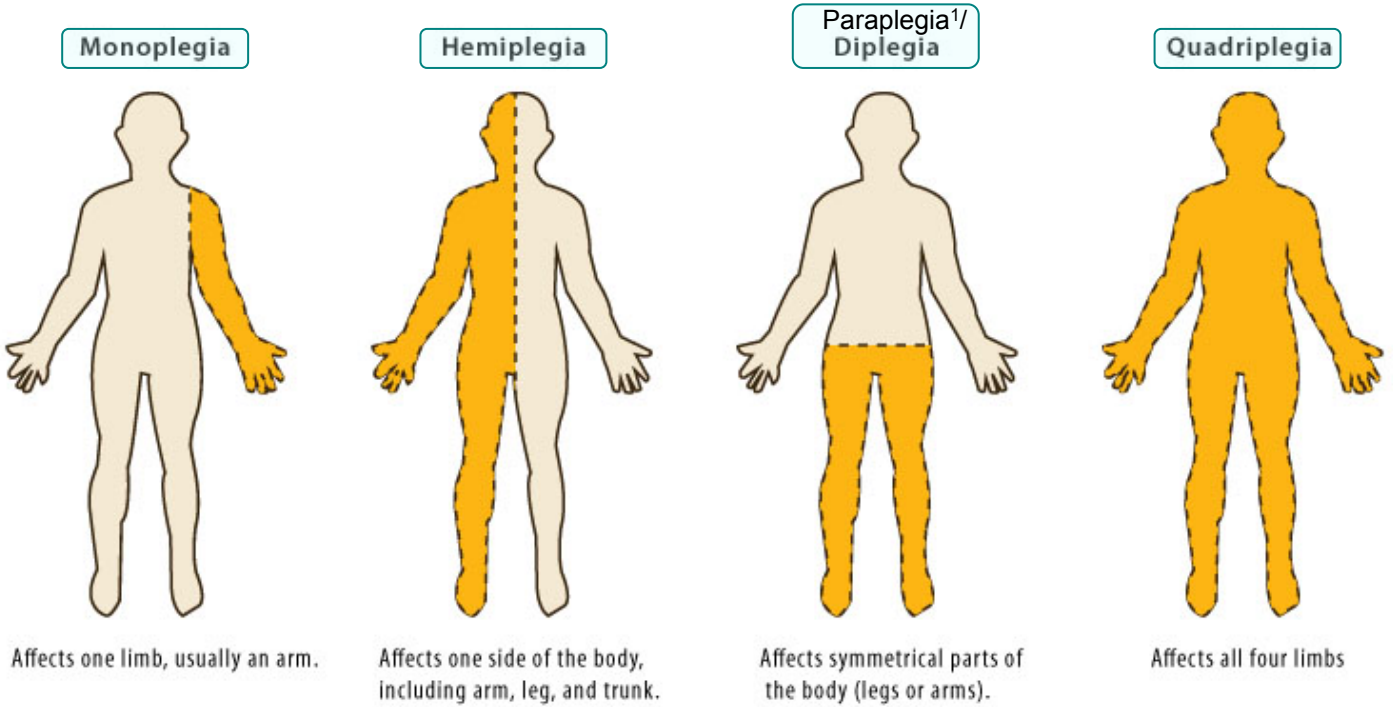
		Upper Motor Neuron Lesion	Lower Motor Neuron Lesion
Extent of Paralysis		Widespread	Localized
Site of Paralysis		Opposite side to lesion (contralateral)	Same side of lesion (ipsilateral)
Tone of Muscles		↑ Hypertonia (Spasticity 'clasp-knife')	↓ Hypotonia (Flaccidity)
Reflexes	Deep Reflexes	↑ Brisk (exaggerated)	↓ Diminished or absent
	Superficial Reflexes	Absent	Absent
	Planter Reflex	↑ Extensor plantar reflex , **up going** babinski sign (dorsiflexion of the big toe and fanning out of the other toes) Feet is pointing to sight of lesion –up- 	↓ Absent or down going babinski sign
Muscle Wasting		↓No marked muscle wasting, but minor wasting may occur (due to disuse atrophy)	↓↓Marked muscle wasting (due to disuse and denervation atrophy)
Clonus[1]		 ↑ Present	↓ Absent
Fasciculations[2] (seen by eye)		↓ Absent	 ↑ Present
Fibrillation (seen by EMG)		↓ Absent	↑ Present

1: Muscular spasm involving repeated, often rhythmic, contractions due to oscillation on tendon strech.

2: Brief spontaneous contraction affecting a small number of muscle fibres, causing a flicker of movement under the skin. Due to increase sensitivity to Ach

This Table Should Be Known By Heart

First you should be familiar with those terms



In Spinal cord injury:

- **Bilateral lesion:** involves both sides of spinal cord
- **Ipsilateral lesion:** involves only one side of spinal cord

1: Paraplegia = effects the **lower extremities**

Additional

Lesion in Different Parts of Motor System

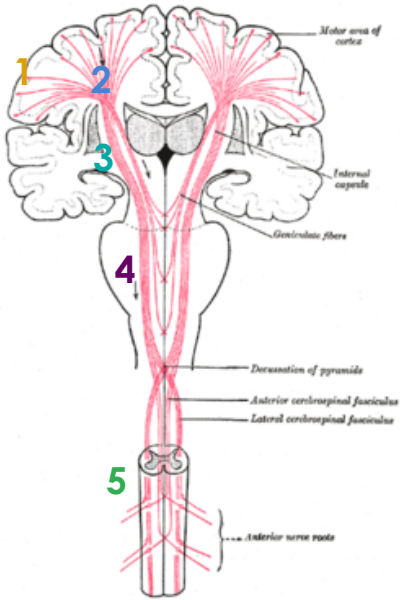
A lesion could happen anywhere in the motor system..

Lesions of pyramidal tract cause paralysis of the **UMNL type below** the level of the lesion. and LMNL type at the same level of lesion.

However, the side affected and the extent of paralysis vary according to the site of the lesion:

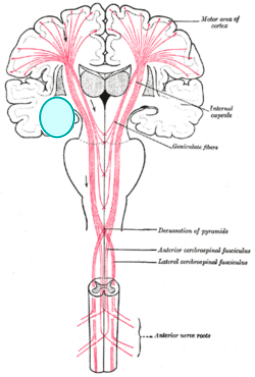
Let's take the Motor system from cortex up to spinal cord and see what happens in each part when Damaged:

Site of Lesion	Effect
1. **Motor area 4**	**Contralateral Monoplegia** Paralysis of one limb because area 4 is widespread so it is rarely damaged completely.
2. **Corona radiate**	**Contralateral Monoplegia or Hemiplegia** Depending on the extent of the lesion.
3. **Internal capsule**	**Contralateral Hemiplegia** Because almost all fibers are injured (Will be discussed next)
4. **Brain stem**	**Contralateral Hemiplegia** **Ipsilateral Paralysis of CNs** (Will be discussed next)
5. **Spinal Cord**	**Bilateral lesions > Quadri/Paraplegia** **Unilateral lesions > Ipsilateral Mono/Hemiplegia** Depending on where exactly in Spinal cord (Will be discussed next)



Lesion in Different Parts of Motor System cont.

in Internal Capsule→ Contralateral Hemiplegia



The internal capsule is the only subcortical pathway through which nerve fibers ascend to and descend from the cerebral cortex.

✧ Characteristics

- It is V-shaped.

- Consisting of:

▪ **The posterior limb, contains:**

✓ The descending pyramidal & extrapyramidal fibers in the anterior 2/3.

✓ The somatosensory radiation that ascends behind the pyramidal fibers from thalamic nuclei to cortical sensory areas.

✓ The optic radiation that ascends behind the somatosensory radiation from the lateral geniculate body to visual areas in the occipital lobe.

✓ The auditory radiation that ascend most posteriorly from the medial geniculate body to auditory areas in the temporal lobe.

▪ **The anterior limb, contains:**

✓ Descending fibers from the cerebral cortex to red nucleus, pons to cerebellum, thalamus, 3, 4, and 6 cranial nerves.

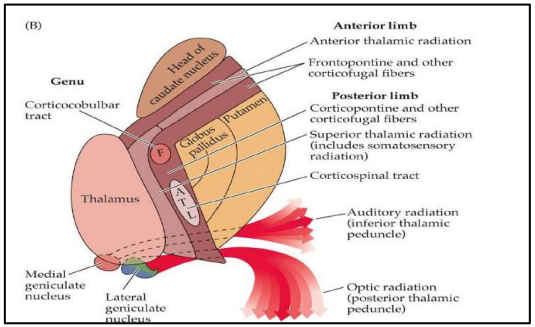
▪ **The genu, contains**

✓ Corticobulbar tract

- Surrounded by:

✓ the putamen and globus pallidus laterally

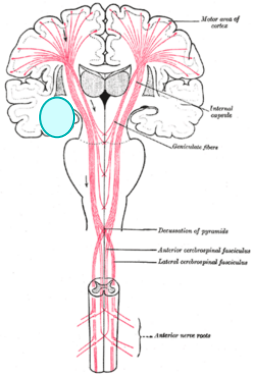
✓ the caudate nucleus and thalamus medially



As you see most fibers passes through internal capsule, the lesion results will be depending on the part of internal capsule that has been effected..

Lesion in Different Parts of Motor System cont.

Effects of a Unilateral Lesion in the posterior limb of internal capsule



A patient had a cerebral stroke of the lenticulo-striate artery (a branch of the middle cerebral artery) that affected the Posterior limb of internal capsule.

During recovery our patient passed 2 stages:

1.Acute 2.Chronic

During the first 2-3 weeks he is having acute UMNL manifestations **but surprisingly we have noticed that he is having some manifestations of a LMNL as well like:**

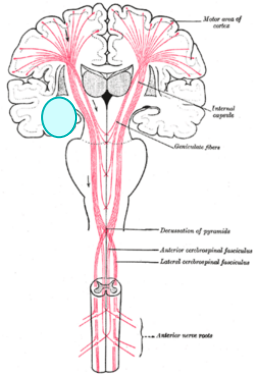
- **Flaccid paralysis** including the UL & LL, the lower parts of the face and half of the tongue.
- **Hemianaethesia** (loss of all sensations).
- **Hypotonia** and **areflexia**.
- **Areflexia**.
- **May be +ve Babinski's sign.**

However, they can be differentiated from the LMNL by :

A. The extent of paralysis **is much more widespread** than in LMNL.
B. There is associated **hemianaethesia.**
C. There **may be +ve Babinski's sign**
D. Absence of muscle atrophy.

Lesion in Different Parts of Motor System cont.

Effects of a Unilateral Lesion in the posterior limb of internal capsule



During recovery our patient passed 2 stages:

1.Acute

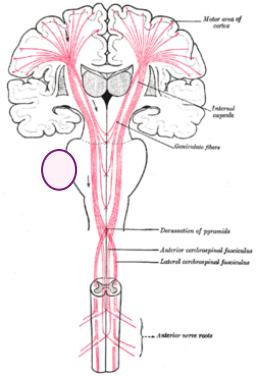
2.Chronic
(Permanent Spastic)

Now our patient partially recovered his manifestations are **summarized** in the table below:

Contralateral hemiplgia of the UMNL type. is so clear now.	
Can stand and even walk, but the fine skilled movements are permanently lost.	Partial recovery of the ipsilateral corticospinal tract, extrapyramidal tracts.
Permanent loss of fine sensations in the opposite side, but the crude sensations recover gradually.	
Contralateral homonymous hemianopia	Because of damage of optic radiation.
Diminished hearing power in both ears (by about 50 %)	Because of damage of auditory radiation.

Lesion in Different Parts of Motor System cont.

in Brain Stem➔ Contralateral Hemiplegia (UMNL Type)



But if the lesion occur at the level of cranial nerves motor nuclei it will be **LMNL type and causes Ipsilateral Paralysis**

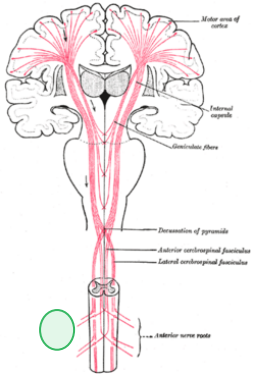
The nerves affected differ as follows:

Area Of Lesion In Brainstem	Cranial Nerves Affected
Midbrain	3rd & 4th
Pons	5th , 6th , 7th , & 8th
Medulla	9th , 10th , 11th & 12th

Recall CNs functions we studied recently in order to know the manifestations ;)

Bilateral lesion in the brain stem is rare but when happens it lead to Quadriplegia & Bilateral paralysis of the cranial nerves.

Lesion in Different Parts of Motor System cont.
in Spinal Cord



Region	Bilateral Lesion Complete Transection	Unilateral Lesion Hemisection
Upper Cervical (Above C5)	**Fatal –Death-** Due to paralysis of all respiratory muscles.	Ipsilateral **hemiplegia**
Lower Cervical (Below C5)	Diaphragmatic respiration is still possible, but the patient suffers complete paralysis of all four limbs **Quadriplegia**	
Thoracic	Normal respiration but the patient ends up with paralysis of both lower limbs **Paraplegia**	Ipsilateral **monoplegia**
In both conditions, there is ipsilateral paralysis (LMNL) of the muscles **at the level** of the lesion due to damage of the spinal motor neurons.		

Complete Transection (Bilateral) of Spinal Cord

E.g. following tumor or trauma

The patient will go into 3 Stages:

1. **Spinal Shock**
2. **Recovery of Reflex Activity**
3. **Paraplegia in Extension**

1. Spinal Shock

Complete Transection of Spinal Cord cont.

Duration	This stage varies in duration but usually lasts a maximum of **2-6 weeks.**
Cause	**Sudden withdrawal of supraspinal facilitation** (continual tonic discharge) on the spinal alpha motor neurons. That comes from: reticulospinal, vestibulospinal and corticospinal tracts.
Manifestations	○ **Paralysis** of all muscles below the lesion (quadriplegia or paraplegia) (UMNL) ○ Complete **loss of all sensation** below the level of transection. ○ **Loss of tendon reflexes and superficial reflexes** below the level of the lesion. ○ **Flaccidity** ➔ ↓Venous return ➔ LL to become cold and blue. ○ **Retention with overflow** ➔Urine dribbling. ○ Loss of vasomotor ➔Vasodilatation ➔**Hypotension.**
Management	This aim at rapid recovery of spinal reflex ○ Preventing infections By: ✓ Antibiotics ✓ Cleaning the skin with antiseptics ✓ Changing Patient position ✓ Catheterizations ○ Adequate nutrition ○ Giving stimulants to the spinal centers

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2. Recovery of Reflex Activity

Complete Transection of Spinal Cord cont.

Cause	○ **Increase in degree of excitability** of the spinal cord neurons below the level of the section. due to: ✓ Disinhibition of motoneurons due to absence of inhibitory impulses from higher motor centers. ✓ Sprouting تنبت of fibres from remaining neurons. ✓ Denervation supersensitivity to excitatory neurotransmitters.
Manifestations	○ Gradual **rise of arterial blood pressure.** ○ **Return of spinal reflexes:** ✓ Flexor tendon reflexes & withdrawal **reflexes earlier than extensor ones.** ✓ Babiniski sign ✓ Paraplegia in flexion ✓ Stretch reflex (muscle tone) ○ **Automatic micturition**, defecation & erection reflexes. ○ **Mass reflex:** A minor painful stimulus to the skin of the lower evoke (by irradiation): ✓ Bladder and rectum will empty, ✓ Skin will sweat ✓ Blood pressure will rise. ○ **Voluntary movements and sensations are permanently lost**.
Management	Patients who are rehabilitated and properly managed may enter into a more advanced stage of recovery -Since effective regeneration never occurs in the human CNS, patients with complete transection never recover fully..-

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Complete Transection of Spinal Cord cont.

3.Extensor Paraplegia

Manifestations	○ **Tone in extensor muscles returns** gradually to exceed that in the flexors. ○ The lower limbs **become spastically extended**. ○ **Extensor reflexes become exaggerated** seen in: ✓ Tendon jerks. ✓ Appearance of **clonus.** ○ Patient can stand on his feet with support (**Positive support reaction**). ○ The flexor withdrawal reflex which appeared in the last stage is associated during this stage with the crossed extensor reflex.

FAILURE

Results from bad management during the recovery stage.

- ○ UTIs
- ○ Bed sores
- ○ Renal failure (patient dies)
- ○ Spinal centers are more depressed (below lesion):
- ✓ Mass reflex and other reflexes ..etc
- ✓ Flaccidity, Body temperature falls.
- ✓ Constipation
- ✓ Urine retention with overflow
- ✓ Depression of VC = Hypotension

Does not nowadays occur because of perfect nursing and the administration of antibiotics.

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Hemisection (Ipsilateral) of Spinal Cord
Browm-Sequard Syndrome

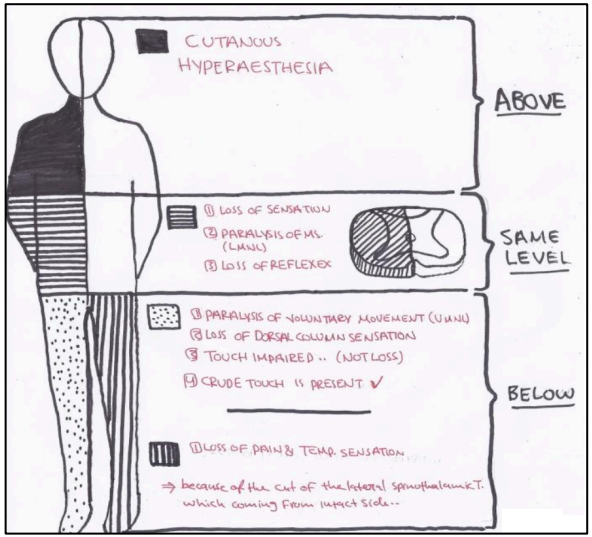
E.g. Due to stab injury, bullet, car accident, or tumor.

Let us say the injury involving the **thoracic** spinal cord Results:

- **At level of lesion (LMNL):**
  - Paralysis to the muscles that are supplied by the damaged segments. (LMNLs type = loss reflexes)
  - Loss sensation is areas of damaged segments.

- **Above level of lesion:**
  - Hyperesthesia (increased sensibility to pain, touch temp) why? due to irritation of the dorsal nerve roots by the neighboring intact neurons.

- **Below level of lesion (UMNL):**
  - Spasticity and clonus
  - Dorsal column sensations are lost.
  - Lateral spinothalamic tract sensations (pain and temperature) are lost -Contralateral-



1- Which of the following features are seen in lower motor lesions?
A. Flaccid paralysis
B. Hyperactive stretch reflex
C. Spasticity
D. Muscular incordination

2- What lesion causes muscle wasting with loss of reflexes and Fasciculations?
A. Upper Motor Neuron Lesion
B. Lower Motor Neuron Lesion

3- What lesion causes clonus and up going babinski sign?
A. Upper Motor Neuron Lesion
B. Lower Motor Neuron Lesion

4- Which lesion where the site of paralysis will be contralateral?
A. Upper Motor Neuron Lesion
B. Lower Motor Neuron Lesion

5- Which lesion causes minor muscle wasting due to disuse only?
A. Upper Motor Neuron Lesion
B. Lower Motor Neuron Lesion

6- A patient is having Poliomyelitis, what type of lesion are you expecting him to have?
A. Upper Motor Neuron Lesion
B. Lower Motor Neuron Lesion

7- Lesion of spinal cord at the level of upper cervical, what will be the result:
A. Death
B. Hemiplegia
C. Paraplegia
D. Monoplegia

8- Which one of the following is the most common site of lesion in motor system:
A. Spinal cord
B. Posterior limb of internal capsule
C. Motor area
D. None

9- Fibrillation is seen in which type of lesions:
A. Upper Motor Neuron Lesion
B. Lower Motor Neuron Lesion

10- Hypertonia is seen in which type of lesions:
A. Upper Motor Neuron Lesion
B. Lower Motor Neuron Lesion

1.A
2.B
3.A
4.A
5.A
6.B
7.A
8.B
9.B
10.A

MCQs

1. A 28-year old women experiences drooping in her left lower facial muscles (below the eye). Her forehead remains unaffected.

Given her symptoms name the type of lesion the site of the lesion

UMNL , genu of internal capsule (corticobulbar)

2. Following a motor bike accident, a 22-year old man presents with paraplegia.

Name the site of injury and the type of lesion.

Thoracic segments of spinal cord, Bilateral

3. A 47-year-old man is transported to the emergency department from the site of an automobile collision. The examination reveals a paralysis of both lower extremities

.Which of the following most specifically identifies this clinical picture?

A.Alternating hemiplegia
B.Hemiplegia
C.Monoplegia
D.Paraplegia

4. A 23 year old man is brought to the emergency room from the site of an automobile collision. The neurological examination reveals weakness of the right lower extremity and a loss of pain and thermal sensations on the left side beginning at the level of the umbilicus. CT shows a fracture of the vertebral column with displacement of bone fragments into the vertebral canal.

A-Which of the following represents the most likely level of damage to the spinal cord resulting from the fracture to the vertebral column in this man?

A. T8 on the left
B. T8 on the right
C. C3 on right
D.C3 on lrft

B-What is the name the syndrome the patient is having ?

Brown-Sequard Syndrome

5. A 79 year old man is experiencing peripheral nerve damage of his lower right limb. What is the type of lesion and mention one feature you'll be seeing?

LMNL, Hypotonia

A 45 year old man, had a trauma affected his thoracic segments of spinal cord bilaterally, for about 2-6 weeks of his trauma his lower limb muscles are paralyzed and show some extent of flaccidity, his urine is dribbling, and when the doctor examine his reflexes he lost biceps and ankle reflexes while the biceps reflex is still intact. The doctor sat a management plan for the patient hoping for a better heal.

1-In which stage the patient is?
Spinal shock

2-What do you think the reason of all his symptoms?
Sudden withdrawal of supraspinal facilitation

3-What is the name of condition that refers to urine dribbling?
Retention with overflow

4-Metion when of the complications of flaccidity?
Decrease venous return > stagnation

5-What is the aim of the management plan?
Preventing infection & stimulate neurons

50 year old woman had a cerebral stroke, MRI shows an area of infarction consistent with the territory served by a branch of the middle cerebral artery , 2 weeks after the incident the patient is having areflexia, flaccidity, Hemianaethesia after examination of reflexes it appears that the Babinski sign is positive.

1-Which structure of the brain the thrombus is affecting?
Posterior limb of internal capsule

2-Mention three structures that passes through the affected part?
Pyramidal tracts, optic and auditory radiation

3-What type of lesions can causes all the manifestations of our patient ? a
Lower motor neuron lesion

4-Regarding question 3 how would differentiated the type of lesion you answered from the other type according to the case?
The Babinski sign is positive which is a characteristic of UMNL

5-In which stage of recovery the patient is?
Acute stage

THANK YOU FOR CHECKING OUR WORK!

BEST OF LUCK

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