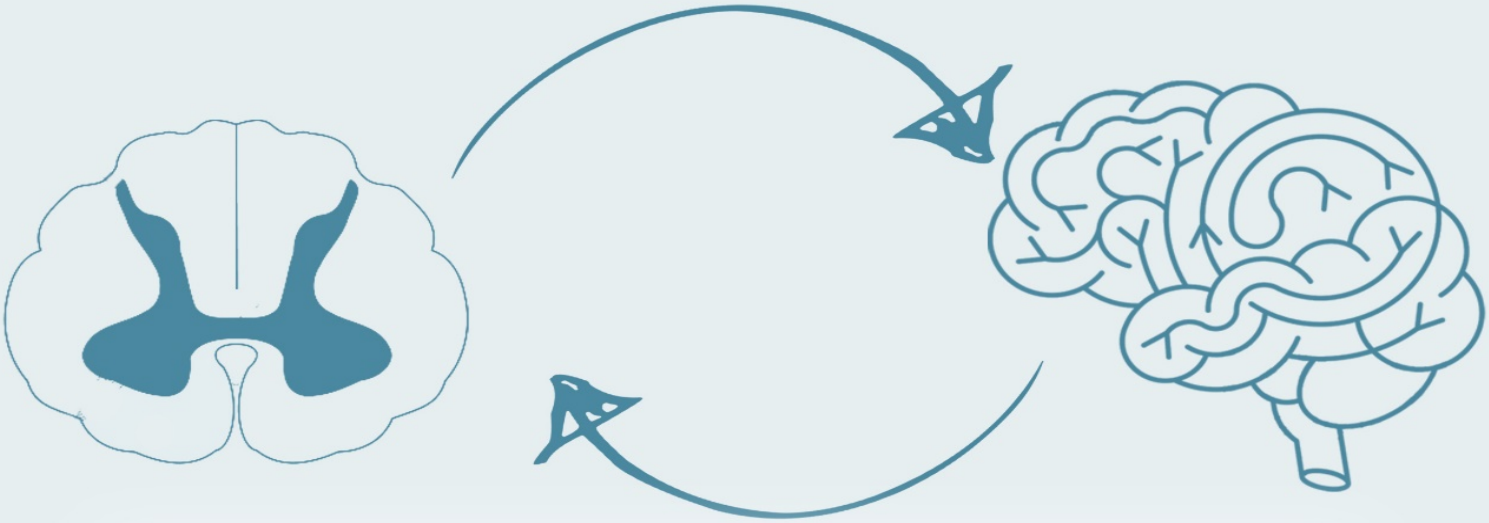

CNS

physiology

slides sheets

number	15
Done by	Basel Baniatta
Correction	Ali Hamad
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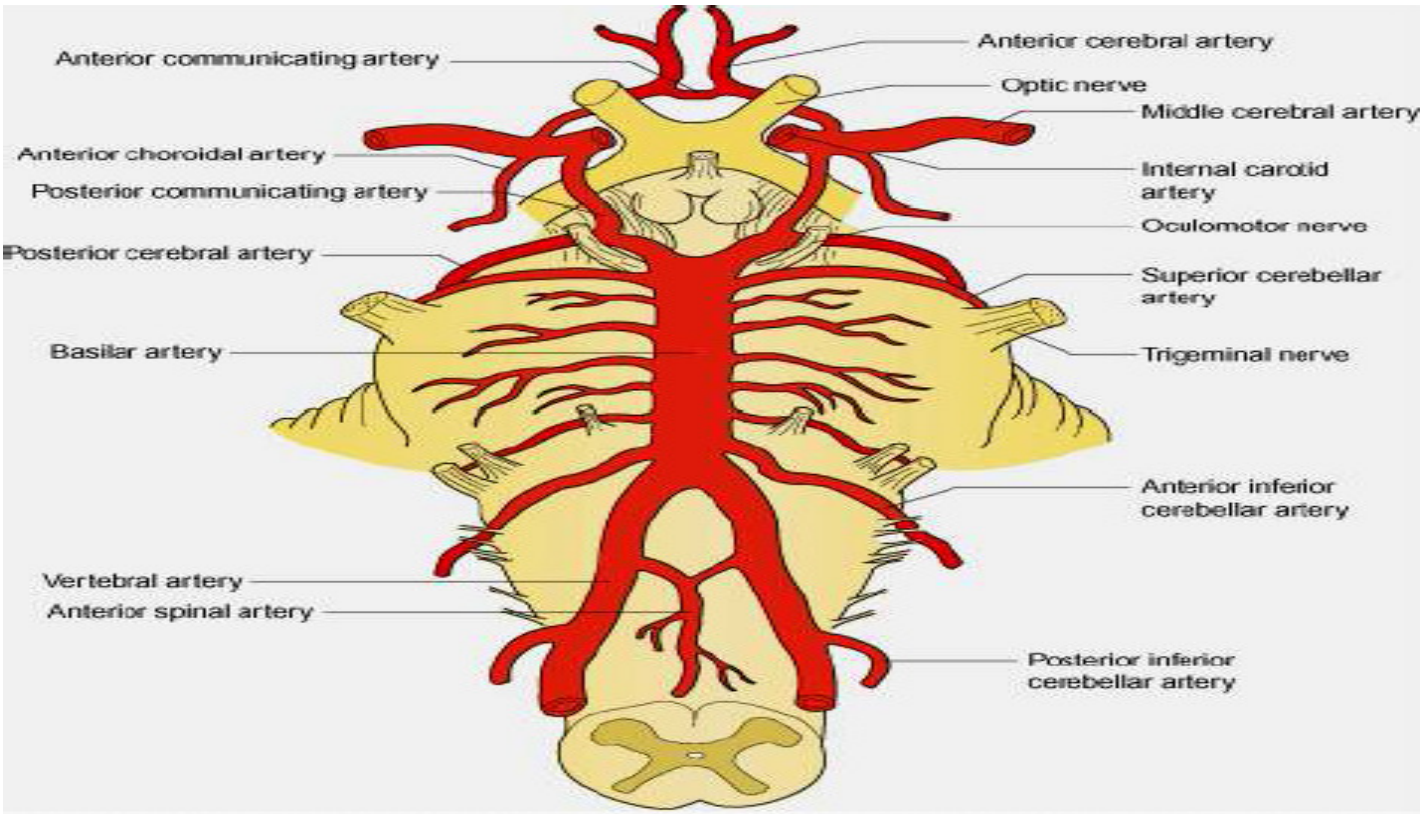
❖ General overview of blood supply of the brainstem:

{Please keep looking at the figure below while reading the blood supply}

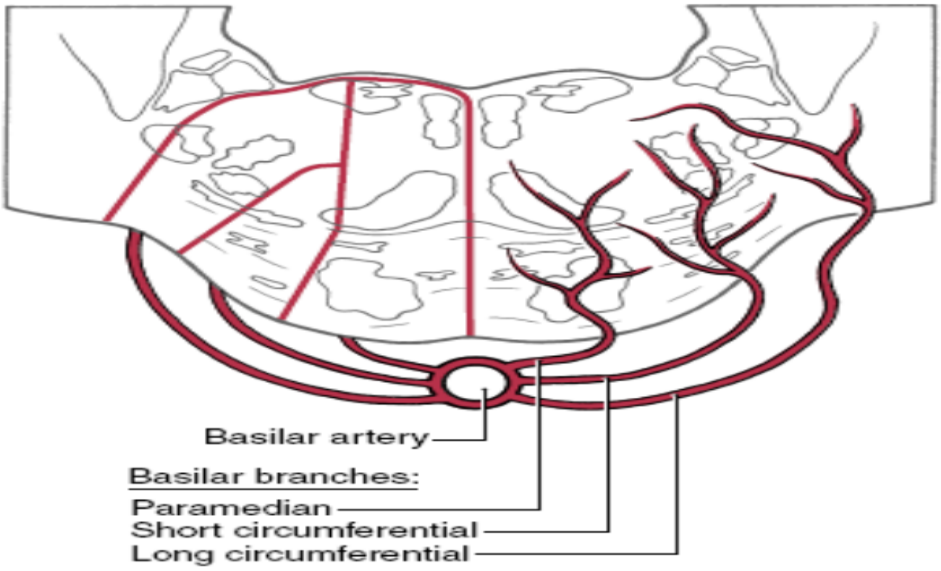
The right and left vertebral arteries arise from the 1st parts of the right and left subclavian arteries respectively. The vertebral artery on each side gives two braches (before anastomosing with each other): (I) anterior spinal branch that contributes in the formation of the anterior spinal artery, (II) posterior inferior cerebellar artery (PICA), which in turn gives a branch called posterior spinal artery.

Note: there is one anterior spinal artery and two posterior spinal arteries because the posterior ones don't unite.

At the lower border of pons the two vertebral arteries join each other to form the basilar artery, which gives: (I) pair of anterior inferior cerebellar arteries (AICA), (II) pairs of pontine arteries that extend along the pons*, (III) pair of superior cerebellar arteries, and terminates as a (IV) pairs of posterior cerebral arteries.



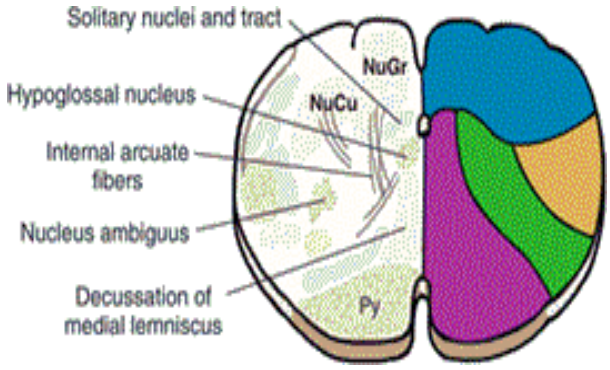
*The pontine arteries are divided into: paramedian, long circumferential and short circumferential arteries. (Look at the figure below)



In this lecture we are going to talk about a group of syndromes caused by occlusion of one of the previously mentioned arteries or other arteries (to be discussed in their related sections).

❖ Syndromes related to Medulla oblongata:

The most medial part of the medulla Oblongata is supplied by the anterior spinal artery (purple) , and the most lateral part is supplied by PICA(yellow) and posterior spinal artery (blue) , while the intermediate part is supplied by vertebral artery (green).



1) **Dejerine syndrome (medial medullary syndrome):**

It's the most common syndrome and characterized by a set of clinical features resulting from occlusion of the ***anterior spinal artery*.** This results in the infarction of the medial part of the medulla oblongata.

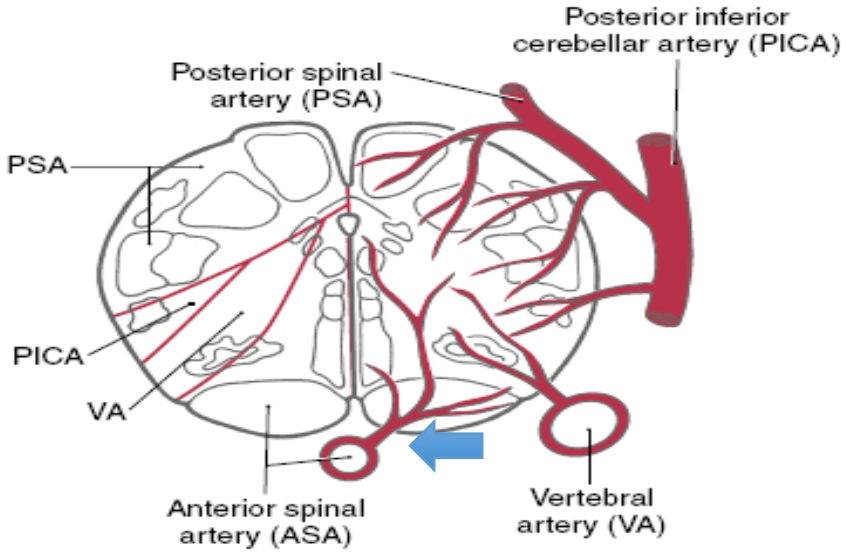
Note: throughout the whole sheet, the order of the structures involved and the order of the corresponding defects are listed respectively. (The first structure corresponds to the first defect….etc)

Structures involved:

- corticospinal fibers in pyramids.
- Hypoglossal nerve fibers or nucleus.
- Medial lemniscus.

Corresponding defects:

- Contralateral hemiplegia: paralysis on the contralateral side of the body, because the fibers aren't crossed yet.
- Ipsilateral deviation of the tongue on protrusion: the hypoglossal nerve supplies the genioglossus muscle and its action is to PUSH the tongue, so weakness of the muscle on one side will lead to deviation of the tongue to the same side.
- Contralateral loss of PCML modalities: vibration, 2-piont discrimination and propriosensation. The loss is on the contralateral side because the fibers are already crossed.



A

2)wellenberg syndrome (lateral medullary syndrome or posterior inferior cerebellar artery syndrome):

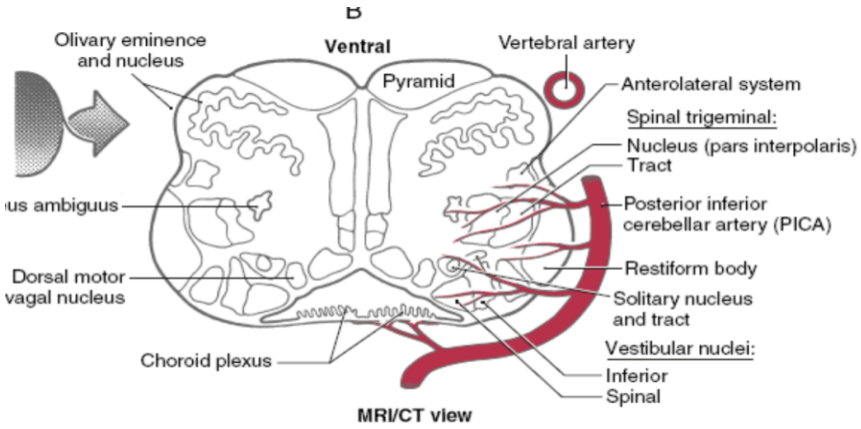
Characterized by a set of clinical features resulting from occlusion of **posterior inferior cerebellar artery (PICA),** this results in infarction of the lateral part of the medulla oblongata.

Structures involved:

- Spinal trigeminal tract.
- Anterolateral system.
- Vestibular nuclei.
- Nucleus ambiguous.
- Restiform body.
- Hypothalamospinal fibers: these fibers are sympathetic fibers that travel with the medullary reticulospinal tract and their defect causes Horner's syndrome.

Corresponding defects:

- Ipsilateral loss of pain and thermal sensation on face.
- Contralateral loss of pain and thermal sensation on the body.
- Vertigo, nystagmus.
- Hoarseness, dysphagia and deviation of the uvula to the opposite side. "Remember: the muscle of uvula on one side is a pulling one, so a defect results with tilting of the uvula towards the healthy muscle."
- Ataxia
- Ipsilateral Horner's syndrome: decreased pupil size, dropping eyelid and decreased sweating.



2) **Less commonly and it is not a syndrome, occlusion in the *posterior spinal artery*, this result in infarction in the lower part of the medulla oblongata.**

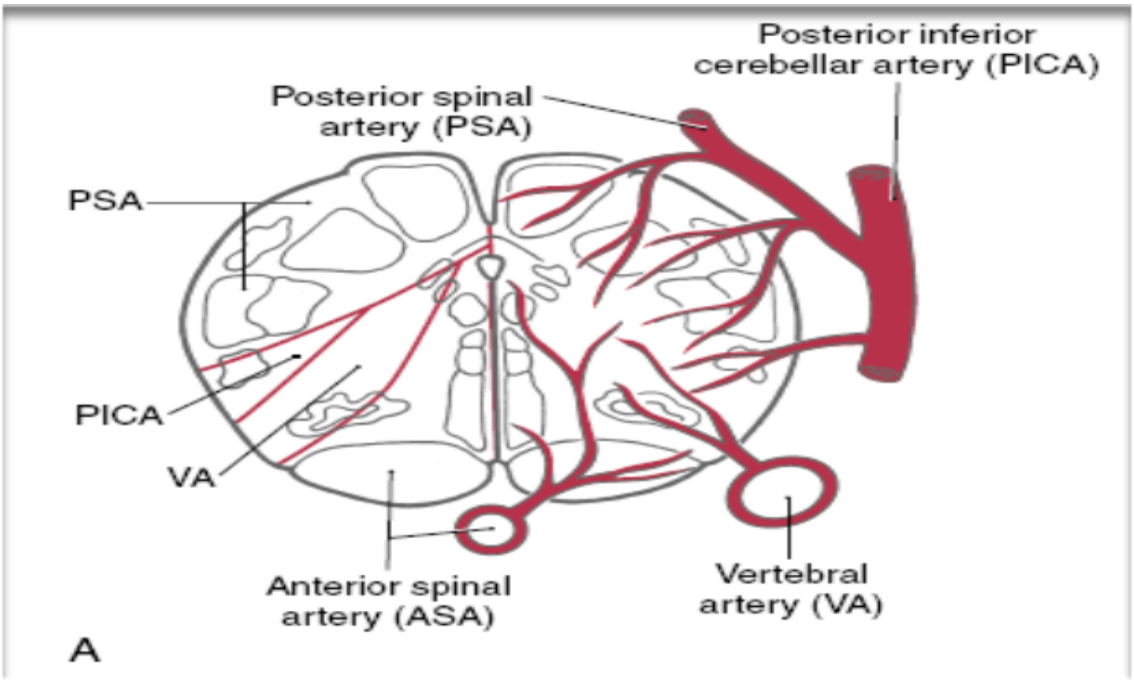
Structures involved:

- PCML nuclei (nucleus gracilis and nucleus cuneatus).
- Spinal trigeminal tract and nucleus.

Corresponding defects:

- Ipsilateral Loss of PCML modalities: 2-point discrimination, vibration and propiosensation.
- Ipsilateral Loss of pain, thermal and crude touch on the face.

Note: The loss of PCML modalities is ipsilateral because the defect is at the level of the nuclei (no crossing yet), the crossing happens after synapsing.
Note: ALS tract isn't affected and its modalities on the body are intact too, because it is supplied directly from PICA not from the posterior spinal.



Pons

The medial part of the pons is supplied by the paramedian branches of the basilar artery, while the lateral part is supplied by the circumferential arteries (long and short).

1) Foville syndrome:

Is caused by the blockage of the perforating branches of the basilar artery (paramedian) on the caudal part of the tegmentum.

Remember: the basilar part of the pons (the anterior part) contains: (I) the crossing fibers of the middle cerebellar peduncle, (II) corticospinal tract.

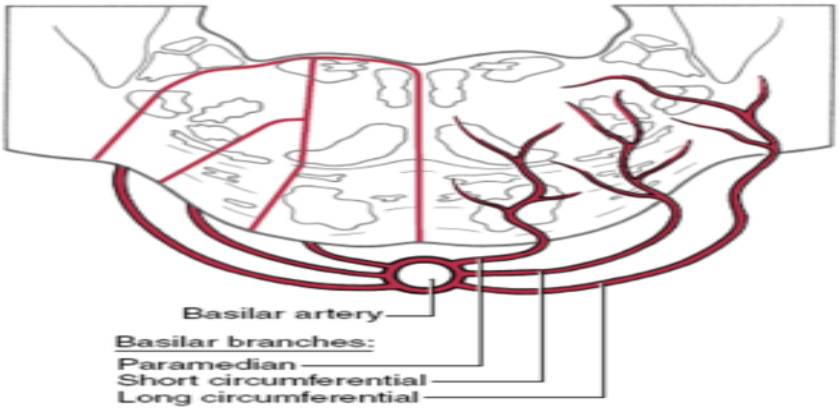
So, if the artery that supplies the basilar part gets occluded on the right side for example, the right corticospinal tract will be affected, and both (right and left) middle cerebellar peduncle fibers will be affected since it's a crossing area and contains fibers from both sides.

Structures involved:

- Corticospinal fibers in basilar pons.
- Abducent nerve fibers.
- Middle cerebellar peduncle (crossing fibers, both left and right).

Corresponding defects:

- Contralateral hemiplegia.
- Ipsilateral abducent palsy, diplopia.
- Ataxia: since both fibers are affected, ataxia is supposed to be on the ipsilateral and contralateral sides of the body, but because the contralateral side is already paralyzed (hemiplegia), it will happen on the ipsilateral side only.



2) Raymond syndrome:it is the same as Foville syndrome but without the involvement of the middle cerebellar peduncle.

3)Gubler or Millard Gubler syndrome:

In this syndrome, the area of damage is shifted somewhat laterally to include the root of the facial nerve and spare the abducent.

Structures involved:

- Corticospinal fibers in basilar pons.
- Facial nerve fiber or nucleus.
- anteriolateral system.
- The trigeminal nerve fibers.(this is what's mentioned in the slides, but in the record the doctor said that the trigeminal will be spared and the medial leminiscus is the affected one).

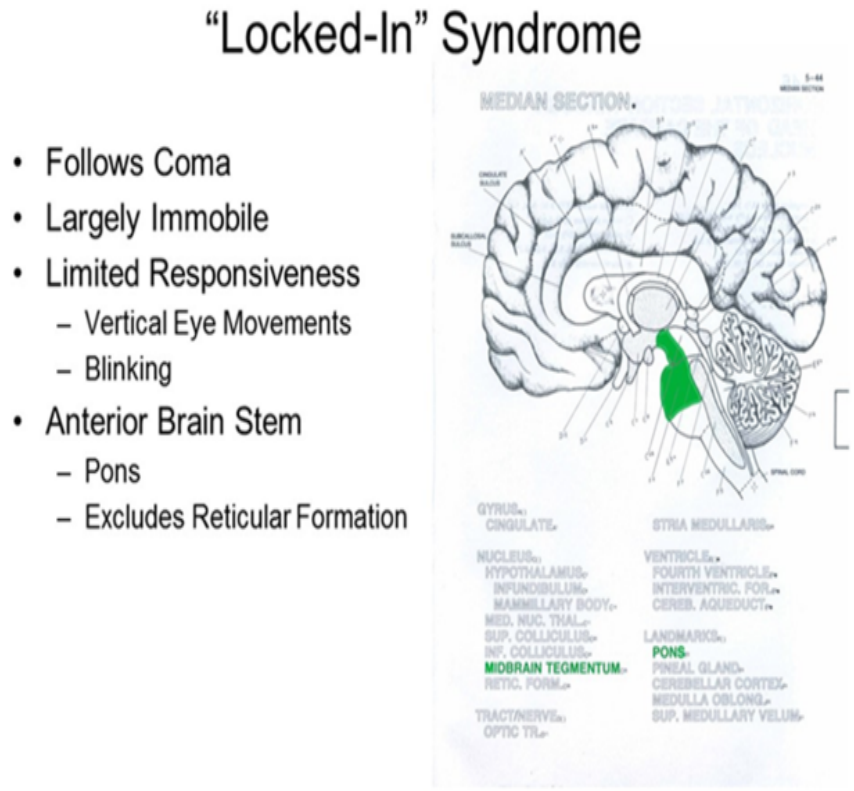
Corresponding defects:

- Contralateral hemiplegia.
- Ipsilateral weakness of facial muscles.
- Contralateral Loss of pain and thermal of the body.
- Ipsilateral loss of pain and thermal of the face.

4) Locked in syndrome (psuedocoma)

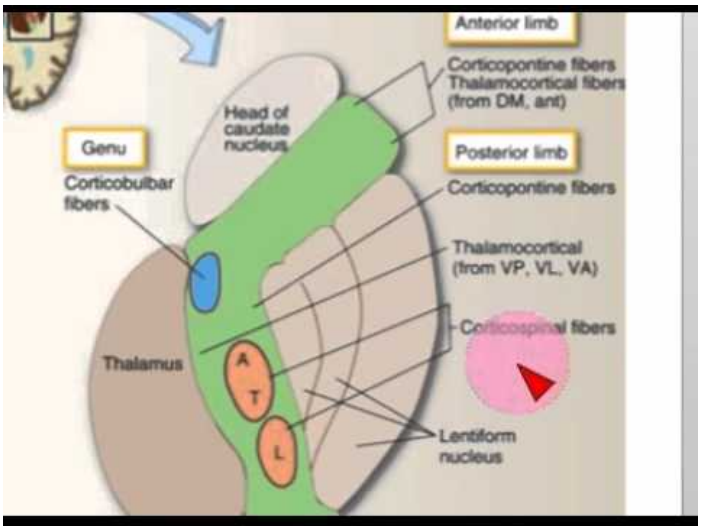
If there is an infarction that involves all of the tegmentum(occlusion in basilar artery), loss of all corticospinal and corticonuclear fibers occurs.

- Complete paralysis (loss of both sides corticospinal and corticonuclear fibers)
- No sensation from the level of the face and below.
- Only the vertical movement of the eye, blinking and fully conscious.



Summary :

SYNDROME	STRUCTURES INVOLVED	CORRESPONDING DEFICIT
Benedikt syndrome (Weber and Claude)	Corticospinal fibers in crus	Contralateral hemiplegia
	Oculomotor nerve fibers	Ipsilateral oculomotor palsy, dilated pupil, diplopia
	Red nucleus	Contralateral tremor, hyperkinesias
	Cerebellothalamic fibers	Contralateral ataxia
	(Medial lemniscus)	(Contralateral loss of vibratory sense, position sense, discriminative touch)
Claude syndrome†	Oculomotor nerve fibers	Ipsilateral oculomotor palsy, dilated pupil, diplopia
	Red nucleus	Contralateral tremor, hyperkinesias
	Cerebellothalamic fibers	Contralateral ataxia
	(Trochlear nucleus)	(Weakness of contralateral superior oblique muscle)
Dejerine syndrome (medial medullary)	Corticospinal fibers in pyramid	Contralateral hemiplegia
	Hypoglossal nerve fibers or nucleus	Ipsilateral deviation of tongue on protrusion
	Medial lemniscus	Contralateral loss of vibratory sense, position sense, discriminative touch
Foville syndrome‡	Corticospinal fibers in basilar pons	Contralateral hemiplegia
	Abducens nerve fibers	Ipsilateral abducens (lateral rectus) palsy, diplopia
	Middle cerebellar peduncle	Ataxia
Gubler or Millard-Gubler syndrome§	Corticospinal fibers in basilar pons	Contralateral hemiplegia
	Facial nerve fibers or nucleus	Ipsilateral weakness of facial muscles
	(Anterolateral system)	(Impaired pain and thermal sense on contralateral side of body)
	(Trigeminal nerve fibers)	(Impaired pain and thermal sense on ipsilateral side of face)
Midpontine base syndrome	Corticospinal fibers in basilar pons	Contralateral hemiplegia
	Trigeminal nerve fibers	Ipsilateral paralysis of masticatory muscles; ipsilateral loss of pain and thermal sensations on face
	Middle cerebellar peduncle	Ataxia
Raymond syndrome	Corticospinal fibers in basilar pons	Contralateral hemiplegia
	Abducens fibers in basilar pons	Ipsilateral abducens (lateral rectus) palsy, diplopia
Wallenberg syndrome (lateral medullary, posterior inferior cerebellar artery)	Spinal trigeminal tract	Ipsilateral loss of pain and thermal sense on face
	Anterolateral system	Contralateral loss of pain and thermal sense on the body
	Vestibular nuclei	Vertigo, nystagmus, nausea, vomiting
	Nucleus ambiguus	Hoarseness, dysphagia, deviation of the uvula to opposite side on phonation
	Restiform body	Ataxia
Weber syndrome	Corticospinal fibers in crus	Contralateral hemiplegia
	Oculomotor nerve fibers	Ipsilateral oculomotor palsy, dilated pupil, diplopia
	Corticonuclear fibers in crus	Contralateral weakness of facial muscles on lower half of face; deviation of the tongue to contralateral side on protrusion; ipsilateral weakness of trapezius and sternocleidomastoid muscles
	Substantia nigra	Contralateral Parkinson-like tremor, akinesia



Lesion in the genu of the internal capsule on one side: the parts that will be affected are the parts that have unilateral innervation, which are

1- genioglossus muscle of the hypoglossal nerve:deviation of the tongue to the opposite side while protruding it.

2-Accessory: ipsilateral paralysis of the shoulder.

3-Vagus: ipsilateral deviation of the uvula.

4-Facial: contralateral loss in the lower part.

Assume that the **right** genu is affected by a lesion; in this case, the part of the **right** hypoglossal nucleus that supplies the genioglossus won't be affected since it takes its fibers from the **contralateral side**. But the left hypoglossal nucleus will be affected because it takes the fibers from the right genu. The same applies for the vagus(nucleus ambiguous) and the facial.

For the accessory, the paralysis is on the same side because it takes from the ipsilateral genu.

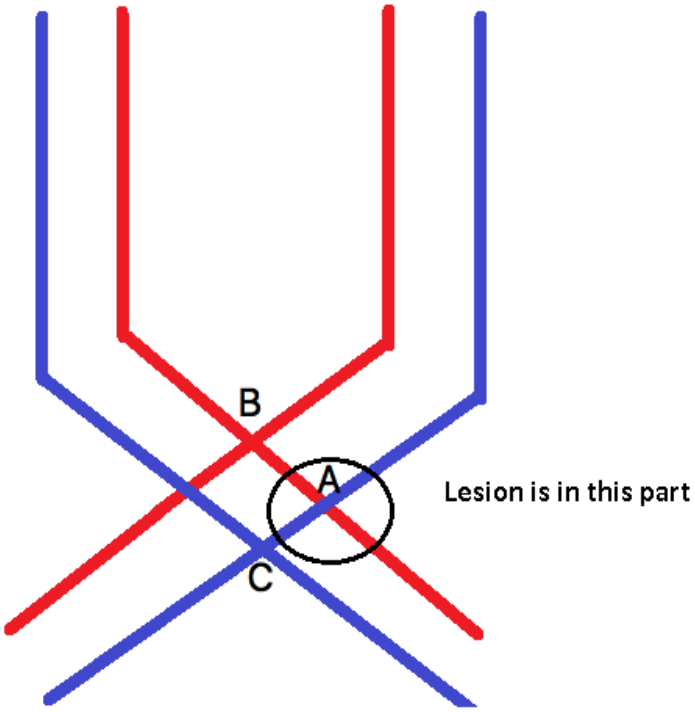
Q: since both the vagus and the hypoglossal nuclei take from the contralateral genu, why the sides of their corresponding defects are different (the hypoglossal on the opposite side while the vagus on the same side)?

Remember that the uvula is a pulling muscle and the genioglossus is a pushing one ……etc.

Motor decussation:

"Remember: the fibers of the corticospinal tract will supply the upper and lower extremities. While descending, the fibers of the upper extremities are medially located whereas the fibers of the lower extremities are laterally located.

Not all the fibers of the corticospinal tract cross at the same time;instead the fibers of the upper extremities (in red)cross at a higher level relative to the level where the fibers of the lower extremities cross (in blue). So, lesions with different locations will have different outcomes.



A) Lesion in the circled area will result in ipsilateral upper extremities paralysis and contralateral lower extremities paralysis.
B) Lesion in area B will result in bilateral upper extremities paralysis.
C) Lesion in area C will result in bilateral lower extremities paralysis.
D) Injury that involves the entire decussation will result with quadriplegia.

GOOD LUCK *_*