



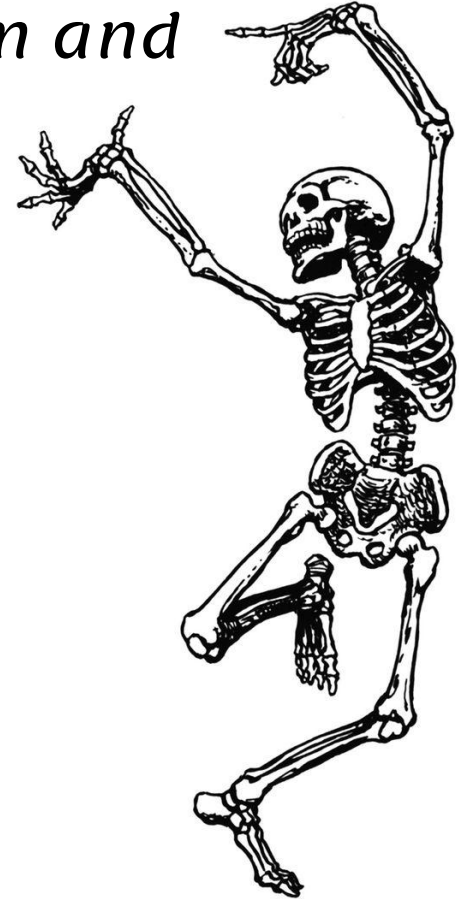
Radiology of the Brainstem and Cerebellum

Second Lecture

Team 437

Radiology

Neuropsychiatry Block



Color index

Important

Doctor's note

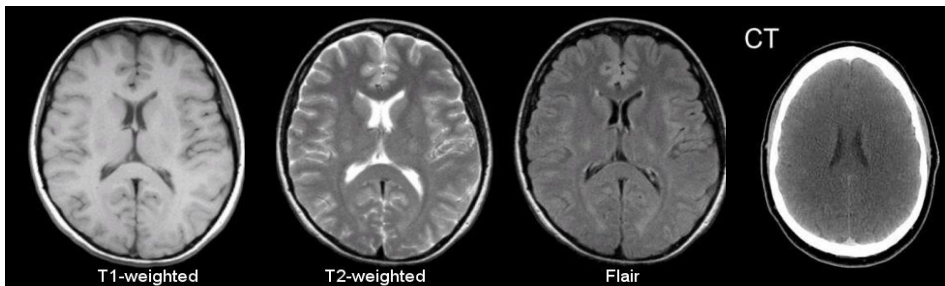
Extra explanation

Lecture objectives:

- 1- Identify radiological anatomy of brainstem and cerebellum.
- 2- compare CT and MRI imaging of brainstem and cerebellum.
- 3- Recognize the imaging findings in common diseases involving brain stem and cerebellum.

Extra information

MRI:



how to differentiate between T1 and T2 sequences?

In general, T1- and T2-weighted images can be easily differentiated by looking at the CSF, CSF is dark on T1-weighted imaging and bright on T2-weighted imaging

how to differentiate between a CT scan and MRI ?

We can use the appearance of **bone** as a reference

CT scan : bright , **MRI** : dark

Some terms that are used in describing abnormalities :

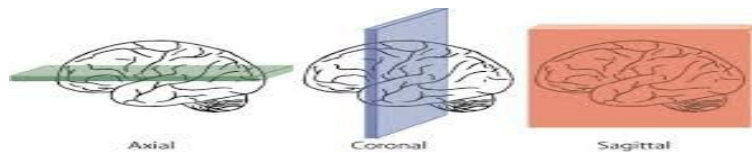
In MRI :
hypointense/dark
hyperintense/bright

In CT scan:
hypodense /dark
hyperdense/bright

The differences between MRI sequences :

Tissue	T1-Weighted	T2-Weighted	Flair
CSF	Dark	Bright	Dark
white matter	Light	Dark Gray	Dark Gray
cortex	Gray	Light Gray	Light Gray
Inflammation (infection, demyelination)	Dark	Bright	Bright

Anatomical planes :



Brain divisions:

The three major divisions of the brain:

1- Prosencephalon: Forebrain

Diencephalon: thalamus , hypothalamus

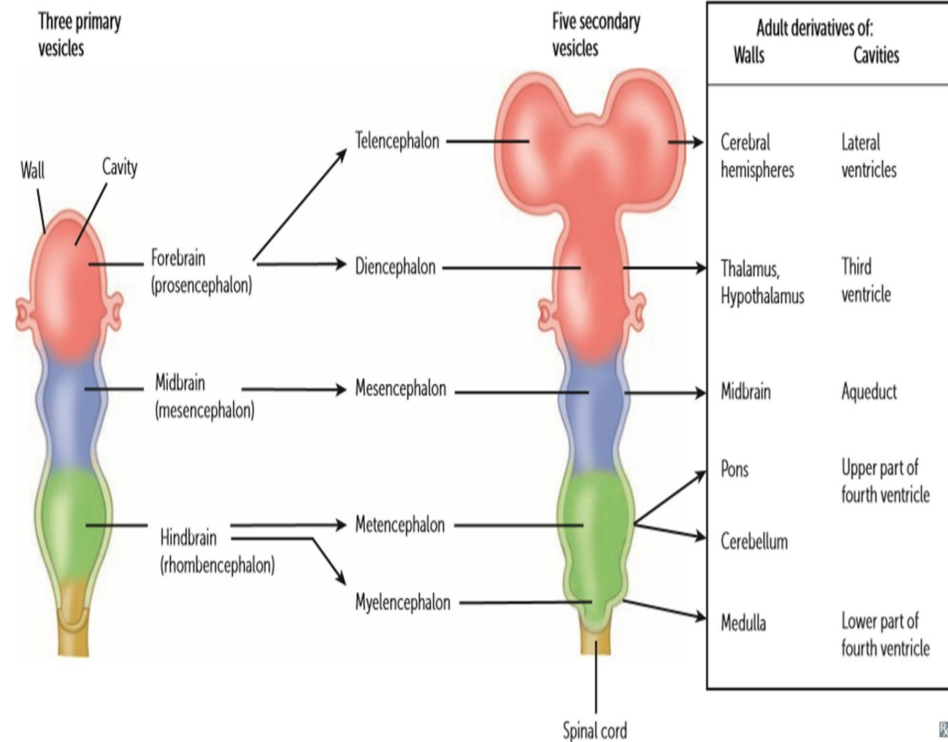
Telencephalon: cerebrum

2- Mesencephalon: Midbrain

3- Rhombencephalon: Hindbrain

Metencephalon: Pons and Cerebellum

Myelencephalon: Medulla Oblongata



MRI T1WI*

Brain stem:

-Three parts from superior to inferior:

1-Midbrain

2-Pons

3-Medulla oblongata

-It connects cerebral hemisphere
with spinal cord.



*MRI T1 Weighted: the CSF is dark.

Midbrain:

Radiological features of the midbrain:

- At the level of circle of willis. (The major blood supply to brain)
- Anteriorly two cerebral peduncles separated by interpeduncular fossa.
- posteriorly four rounded prominences (superior and inferior Colliculi).*

CT

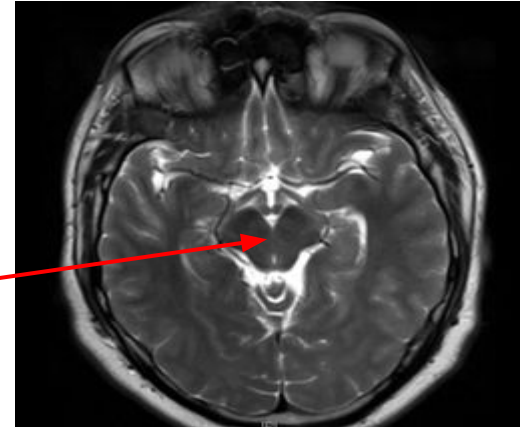


Axial

Midbrain

MRI T2WI

(CSF appears white, so it's T2)



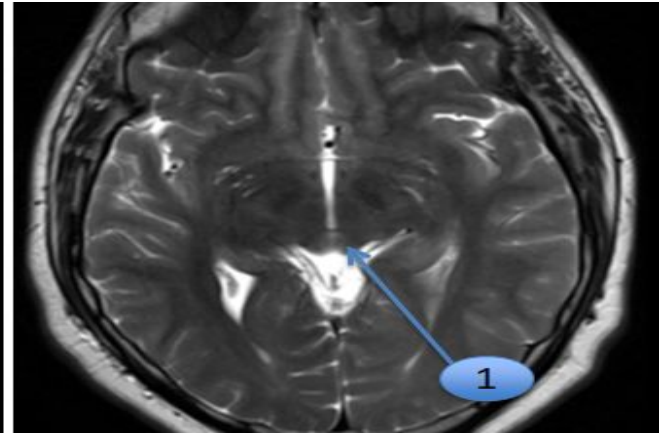
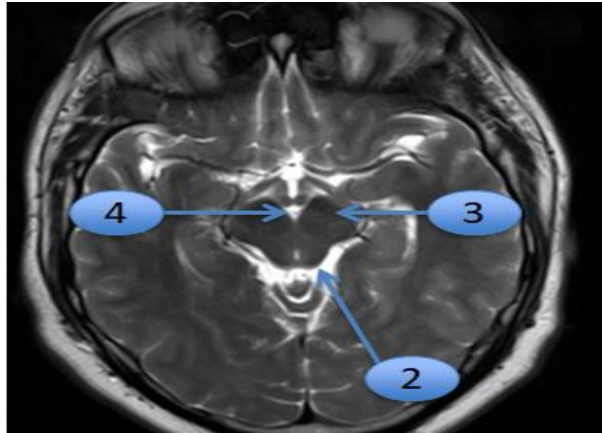
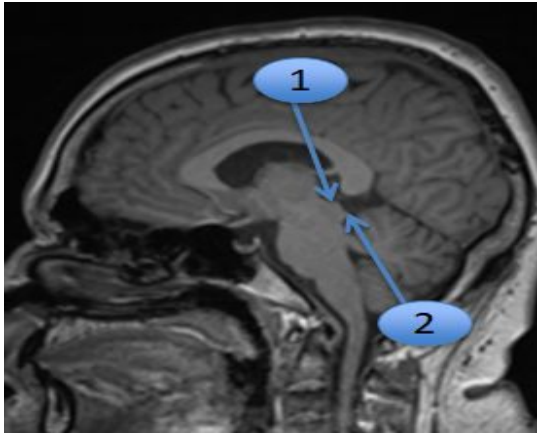
*Together they are called the **Quadrigeminal plate**

Midbrain:

- 1- Superior colliculus
- 2- Inferior colliculus
- 3- Cerebral peduncle
- 4- Interpeduncular cistern



-MRI views:
T1: Dark fluid
T2: White or Bright fluid



Sagittal

MRI T1WI

Sagittal

MRI T2WI

Axial

Midbrain:

Internal features:

- Substantia nigra separates crus cerebri ventrally from tegmentum posteriorly*
- Red nuclei are dorsal to substantia nigra at the level of superior colliculi.

-Both of Red nuclei and substantia nigra appear dark in MRI T2 because they contain iron.

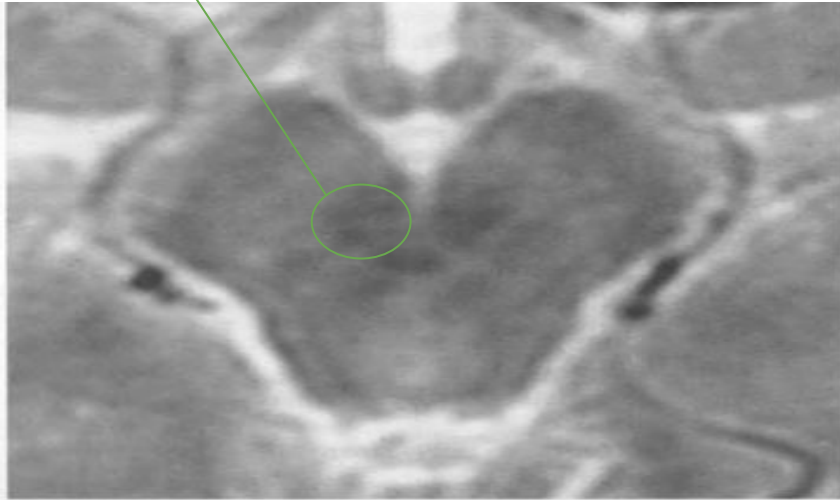
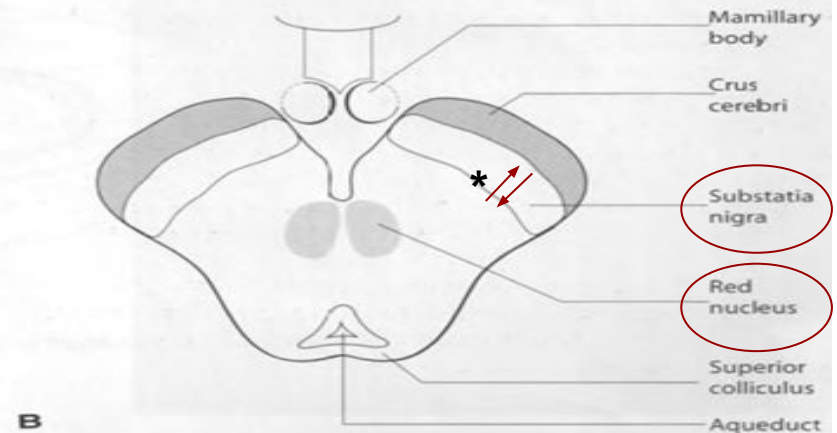


Fig. 2.14 Midbrain, axial section: (a) T₂ MRI; (b) diagram.



Pons:

Radiological features:

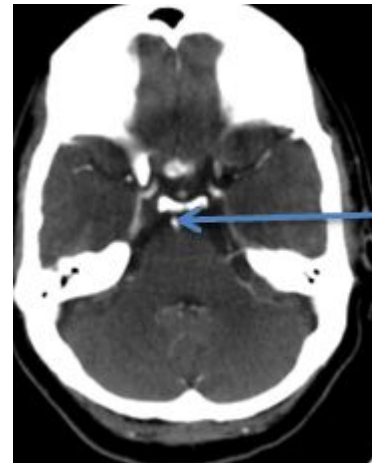
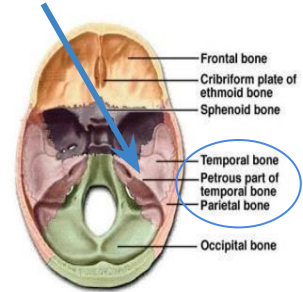
- The bulbous anterior part consists mainly of fibers continuous on each side with middle cerebellar peduncle.
- Basilar artery lies in groove anteriorly.
- Posterior surface of the pons forms the upper part of the floor of the 4th ventricle.
- Bony anterior relation: clivus centrally and petrous temporal bones laterally.



CT+



Petrous bone



Basilar Artery

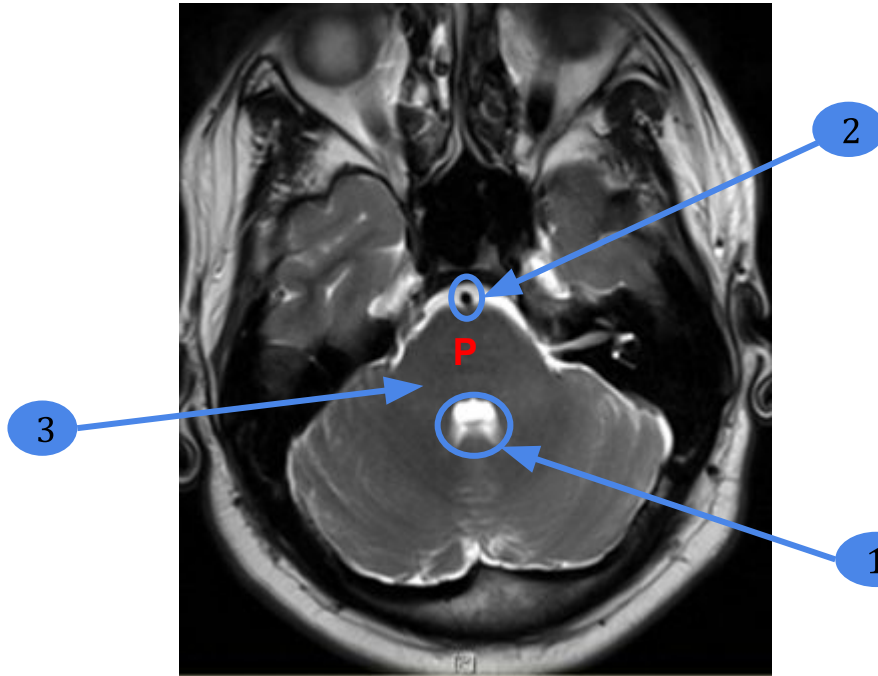
Pons:

P- Pons

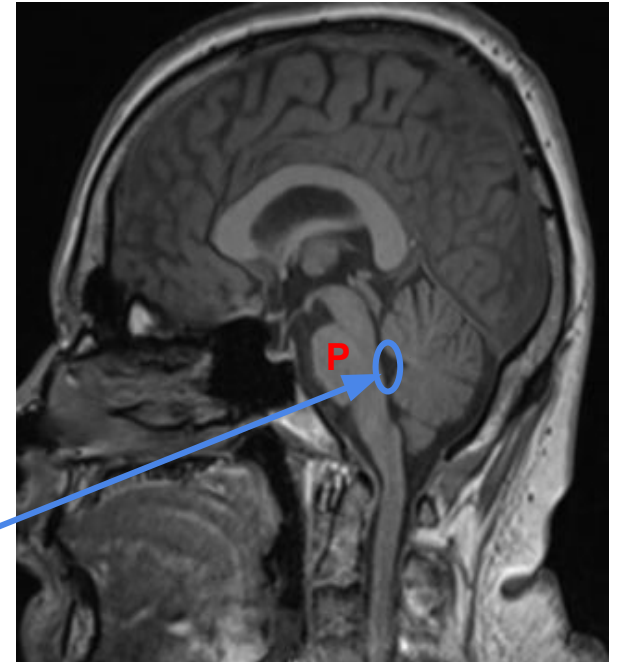
- 1- 4th ventricle***
- 2- Basilar artery**
- 3- Middle cerebellar peduncle**

*White because there's fluid and T2WI makes fluid appear whitish

MRI Axial T2WI



MRI Sagittal T1WI



Medulla Oblongata:

radiological features:

MRI imaging of the medulla gives superior images to CT due to lack of bony artifact.

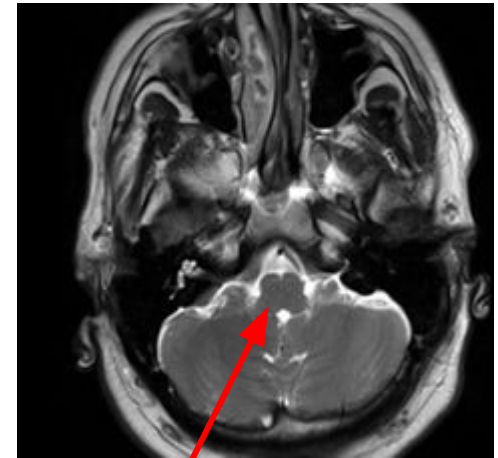
The ventral median fissure is seen anteriorly with the pyramid laterally.

The 4th ventricle is seen posteriorly.

CT +



MRI axial T2WI



Medulla

Cerebellum:

-Cerebellum is connected to the brainstem by three pairs of cerebellar peduncles:

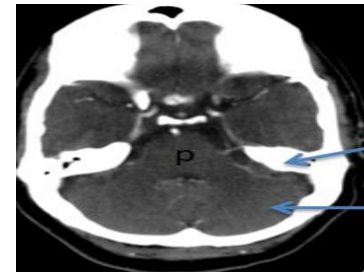
- Superior.....connected to the midbrain
- Middle.....connected to the pons
- Inferior.....connected to medulla oblongata

Radiological Features:

-On axial CT & MRI the cerebellum is separated from the Pons by the 4th ventricle and is connected to the Pons on each side by the middle cerebellar peduncle, it is bounded anteriorly by petrous temporal bone.

-On higher slices it is separated from the temporal and occipital lobes anterolaterally by tentorial margins, tentorium can be seen on contrast enhanced studies owing to the contained superior petrosal sinus

CT+



Petrous bone

Cerebellum



Tentorium

Middle cerebellar peduncle

Cerebellum:

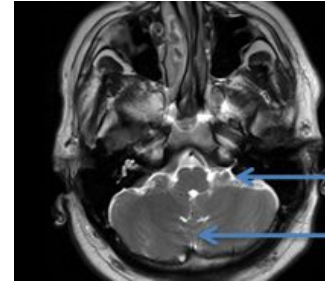
-Two cerebellar hemisphere with midline vermis.

-Flocculus is a small ventral portion of the hemisphere.

-Tonsils are the most anterior inferior part of the hemispheres that lie close to the midline.

-The superior vermis can be seen between occipital lobes on section through the thalamus.

MRI Axial T2 WI



flocculus

vermis

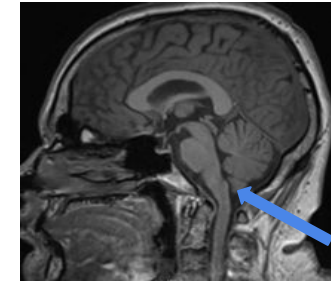


Axial CT



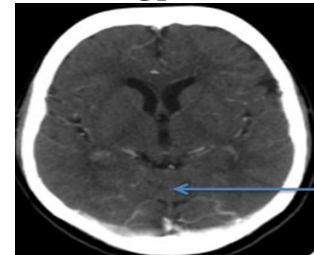
tonsil

MRI Sagittal T1 WI



tonsil

CT+



Superior vermis

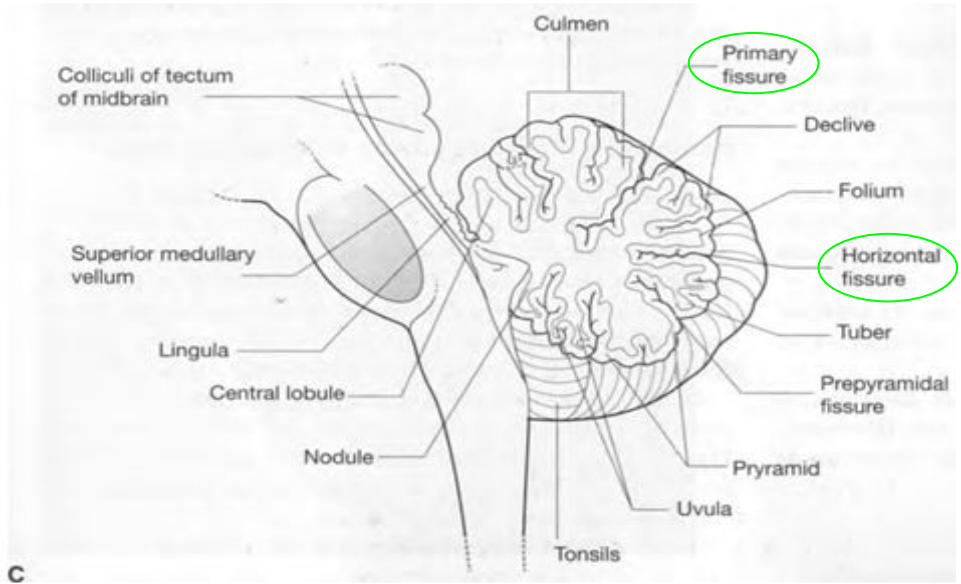
Cerebellar Vermis:

-Most important fissures are the Primary and Horizontal fissures.

Fig. 2.16 Midline sagittal T₂ MRI to show vermis of cerebellum.

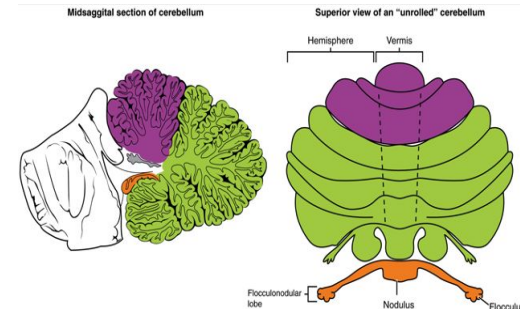


- 1. Lingula on superior medullary velum
- 2. Primary fissure
- 3. Horizontal fissure
- 4. Prepyramidal fissure
- 5. Foramen of Magendi



-Cerebellar vermis is only visible through the midline

-The cerebellar vermis has 3 Fissures and 9 Lobules

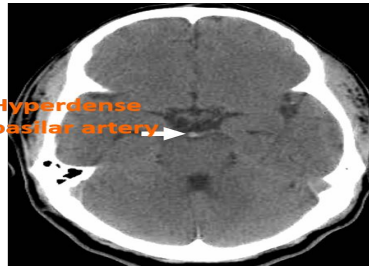


Common diseases of brainstem and cerebellum:

1-Acute infarction due to basilar artery thrombosis

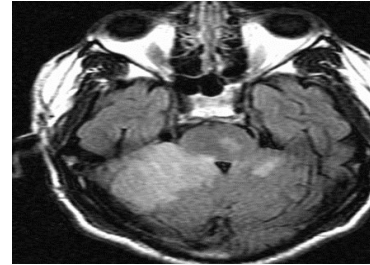
-MRI is better in detecting infarctions than CT

CT*

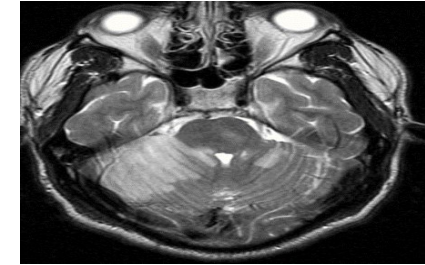


*Normally vessels don't appear bright, The bright appearance indicates a thrombus

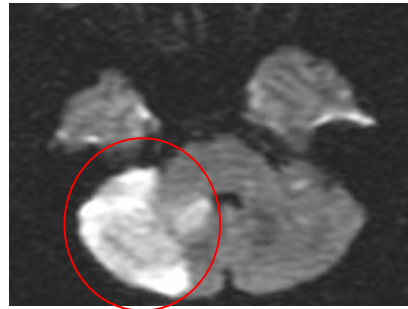
MRI axial flair



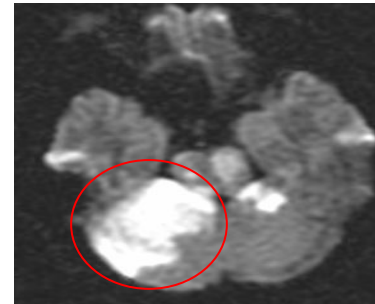
MRI axial T2 WI



Diffusion sequence



-The infarcted tissue appears very white



-Diffusion- Weighted MRI is very sensitive in detecting infarctions very early, that's why it's **very important** in such cases.

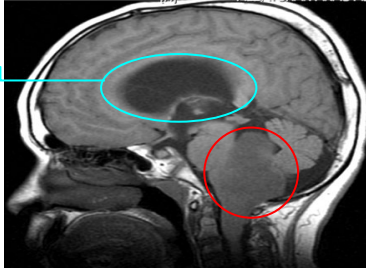
2. Brainstem Glioma

-The **Tumor** is arising from the posterior part of the **Medulla Oblongata**
the mass is compressing the 4th ventricle

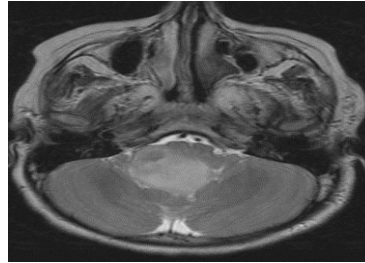


-Obstruction of
the 4th ventricle
leads to
hydrocephalus

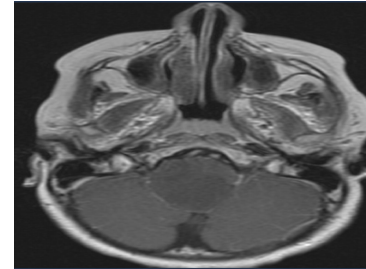
Sagittal MRI T1 WI



axial MRI T2 WI



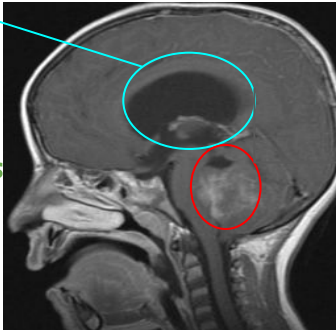
axial MRI T1 WI contrast



3. Medulloblastoma

-The **Tumor** is arising from the **Cerebellum** and part of the 4th
Ventricle.

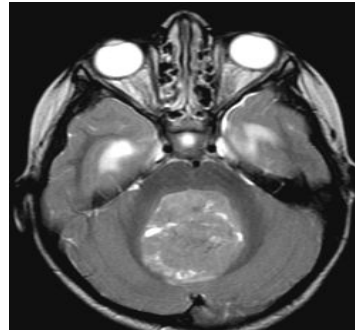
Sagittal MRI T1WI contrast



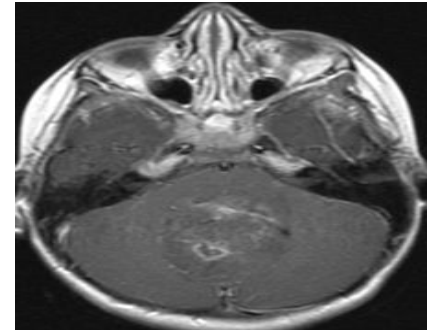
-Because the 4th
ventricle is
obstructed the
lateral ventricle is
dilated

-Common in
pediatric
patients

Axial MRI T2 WI



Axial MRI T1 WI contrast

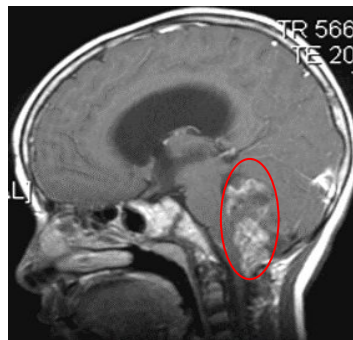


3-Ependymoma

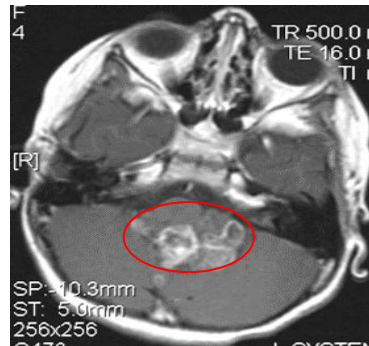
-Within the **4th ventricle** , the tumor extends through the outlet foramina beyond the 4th ventricle into the foramen of magendie “characteristic for Ependymoma”



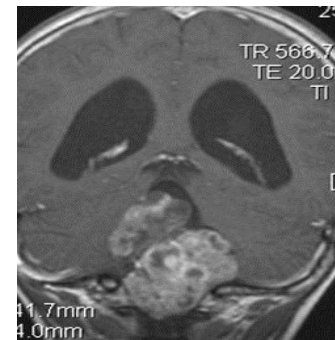
Sagittal MRI T1 WI contrast



axial MRI T1 WI contrast



Coronal MRI T1 WI contrast



4. Hemangioblastoma

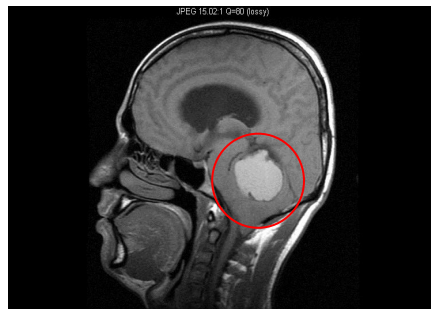
-Vascular tumor.

-The mass is bright on T1

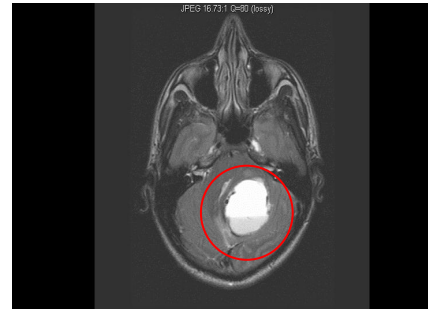
-Not within the 4th ventricle

-The mass is within the cerebellar hemispheres

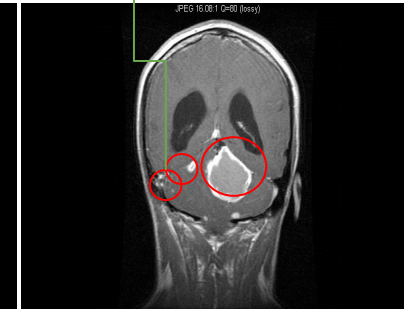
Sagittal MRI T1 WI



Axial MRI T2 WI



Coronal MRI T1 WI contrast

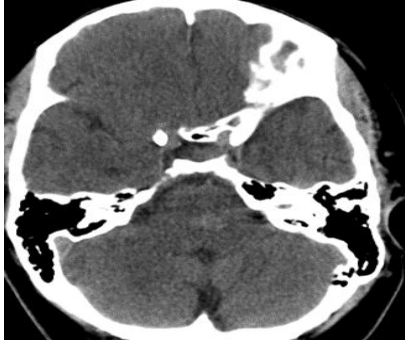


-Multiple small other lesions appear only with contrast

5. Cavernous Angioma

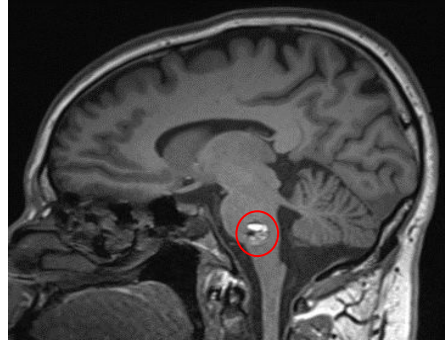
-Benign tumor

CT



- Cavernous Angioma is a Vascular malformation, here we can see it in the central part of **Pons**.

Sagittal MRI T1 WI



*MRI SWI:
Good to detect hemorrhage and calcification



Axial MRI T2 WI



Axial MRI SWI*

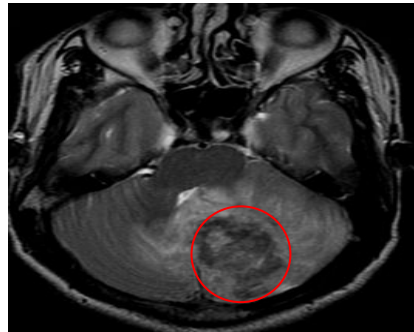


6. Cerebellar tuberculosis

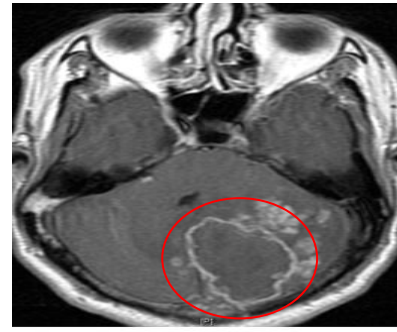
-Affecting the **Left side of Cerebellum**.

-Extensive edema

Axial MRI T2 WI



Axial MRI T1 Contrast

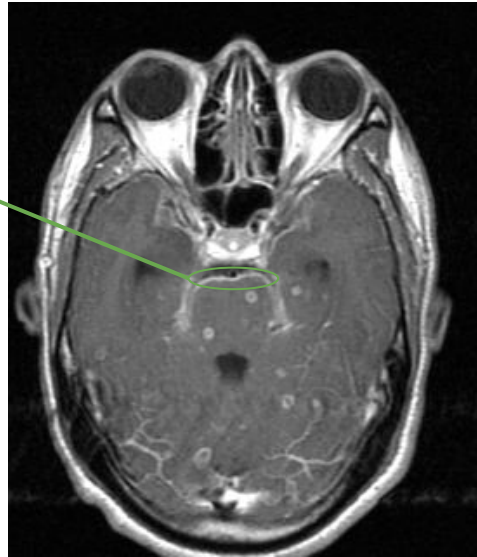


-Tiny nodules around the mass indicate an infection

7. TB meningitis with multiple tuberculomas

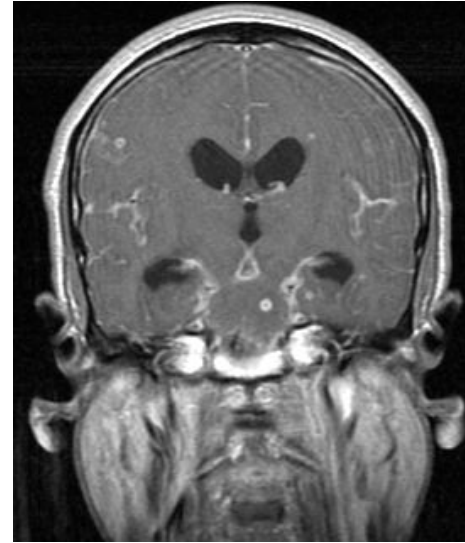
-Affecting the **left side of the Pons.**

Axial MRI T1 Contrast



-Thickening of the
Dura in.

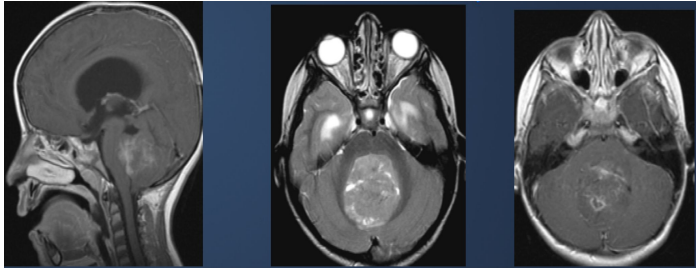
Coronal MRI



MCQs:

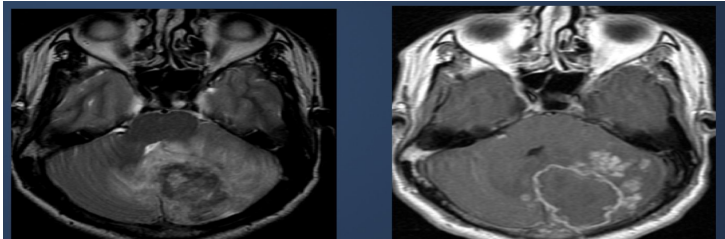
Q1: The MRI is showing Medulloblastoma.. from which part is it arising from ?

- A)) pons B)) cerebellum. C)) medulla D)) midbrain



Q3: the MRI in the picture is showing Cerebellar tuberculosis .. from which part is it arising from ?

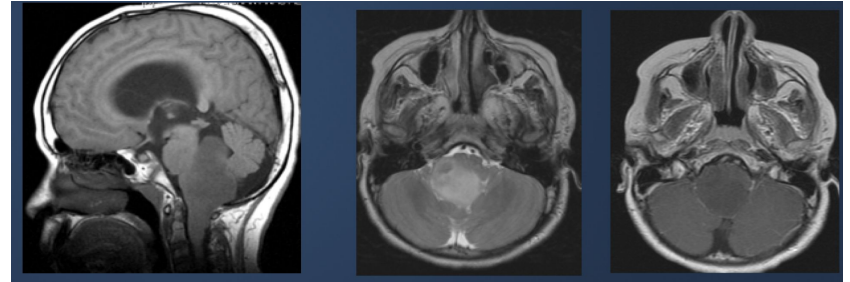
- A)) right cerebellar B)) middle cerebellar C)) left cerebellar



1 B. 2 C. 3 C. 4 C.

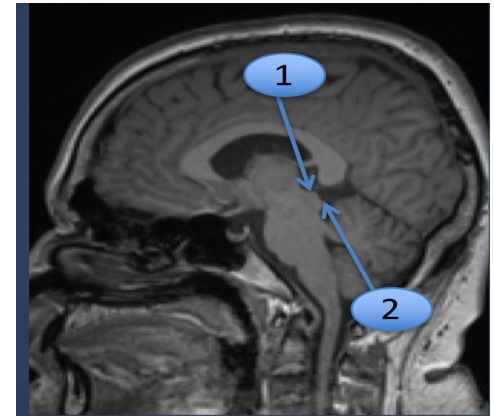
Q2: the MRI in the second picture is showing Brain stem glioma .. from which part is it arising from ?

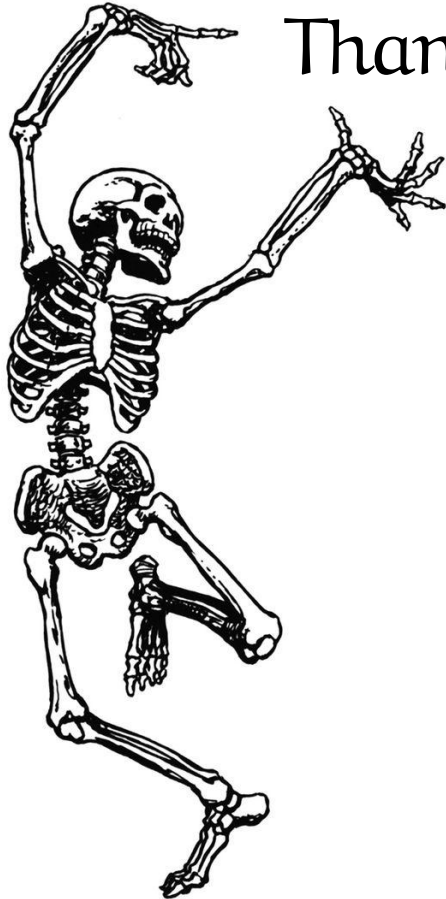
- A)) pons B)) cerebellum. C)) medulla D)) midbrain



Q4 : the arrow of number 1 is showing ..

- A)) lateral ventricle B)) inferior colliculus
C)) superior colliculus





Thank you for checking our work

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