



Lecture 2 :

# Radiology of Brainstem and cerebellum



KSU | Collage of Medicine  
2<sup>nd</sup> Year | CNS BLOCK

# Objective

## Students at the end of the lecture will be able to:

- Identify radiological anatomy of brain stem and cerebellum.
- Compares CT and MRI imaging of brain stem and cerebellum.
- Recognize the imaging findings in common diseases involving brain stem and cerebellum.

### Notes:

- Location of disc & body are important
- Tumor (they'll ask you about the location of the lesion )
- Diseases are important
- Green color & red boxes = note



# □ There are three major divisions of the brain:

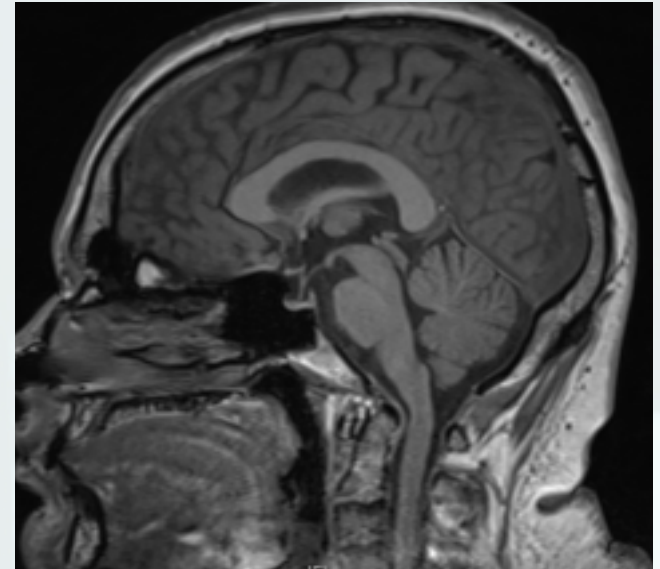
## 1. Prosencephalon – Forebrain

Diencephalon thalamus, hypothalamus  
Telencephalon cerebrum

## 2. Mesencephalon – Midbrain

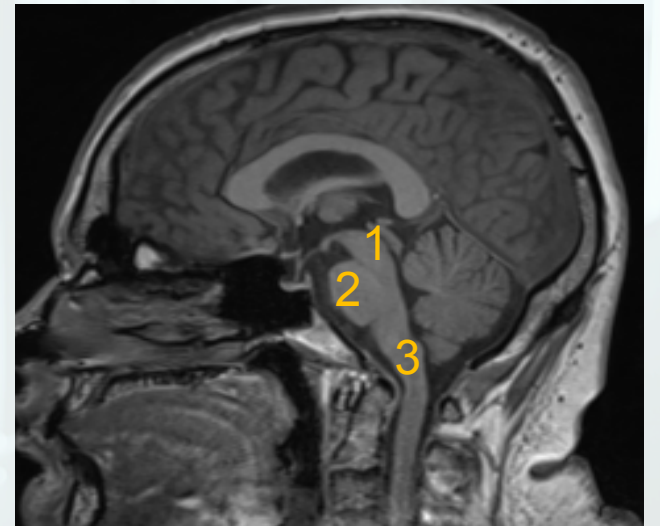
## 3. Rhombencephalon - Hindbrain

Metencephalon pons and cerebellum  
Myelencephalon medulla oblongata



# □ Brain Stem:

- Three parts from superior to inferior:
  - 1 midbrain
  - 2 pons
  - 3 medulla oblongata
- Connects cerebral hemisphere with spinal cord

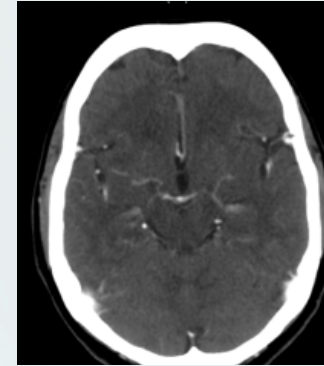


# Midbrain:

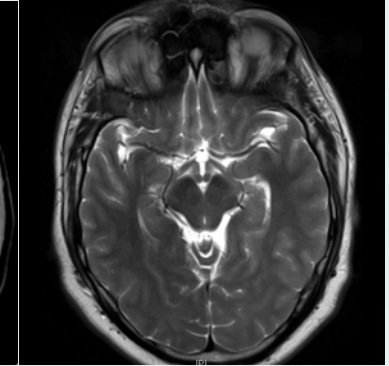
## Radiological Features:

- At the level of circle of willis
- Anteriorly two cerebral peduncles separated by interpeduncular fossa
- Posteriorly four rounded prominences (superior and inferior colliculi)

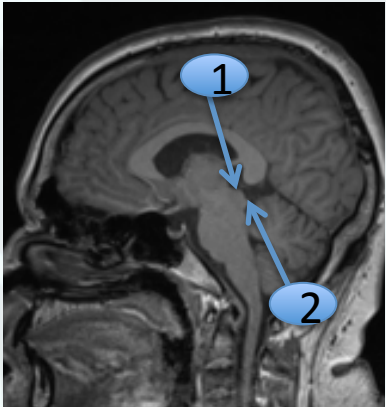
CT+



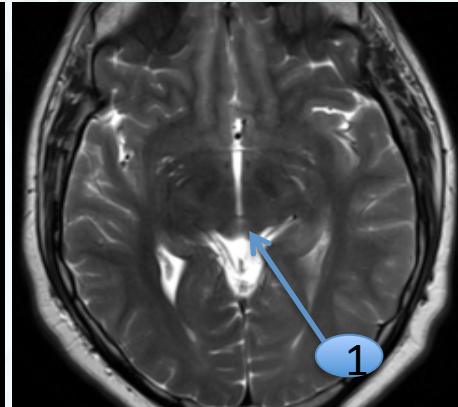
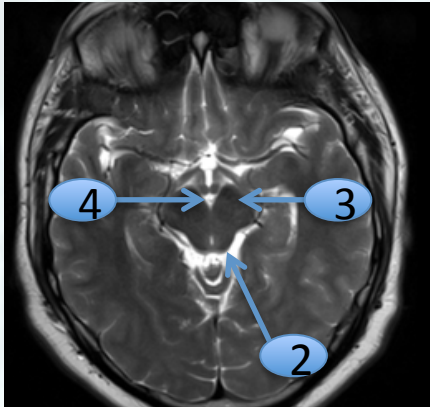
MRI T2WI



MRI Sagittal T1WI



MRI axial T2WI



- 1 superior colliculus
- 2 inferior colliculus
- 3 cerebral peduncle
- 4 interpeduncular cistern

## 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 them are dark because of iron.

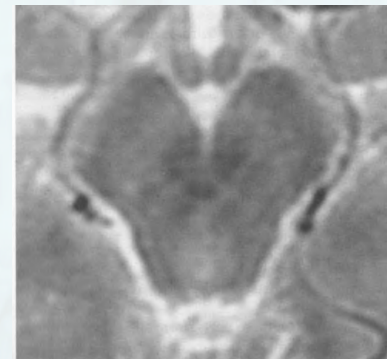
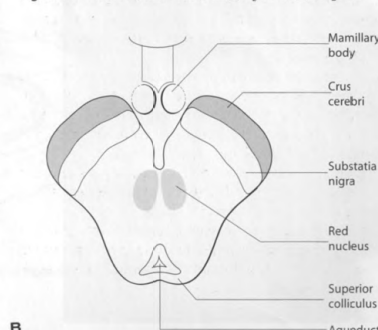


Fig. 2.14 Midbrain, axial section: (a) T<sub>2</sub> MRI; (b) diagram.





# □ Pons:

## Radiological Features:

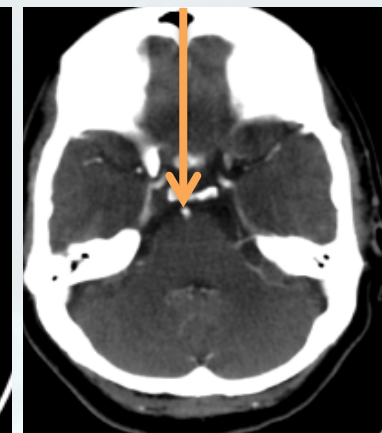
- The bulbous anterior part consists mainly of fibres continuous on each side with middle cerebellar peduncle
- Basilar artery lies in groove anteriorly (black colour)
- Posterior surface of the pons forms the upper part of the floor of the 4<sup>th</sup> ventricle.
- Bony anterior relation:  
clivus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

CT+

Petrous bone

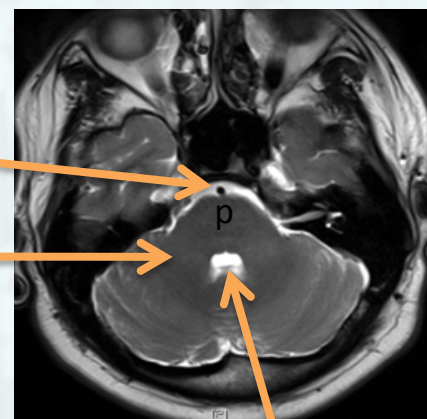


Basilar artery



- Seeing petrous bone indicates that we have reached the level of bone
  - basilar artery in white color indicates infarction of the artery

MRI axial T2WI



MRI Sagittal T1WI



P- pons

1- 4th ventricle

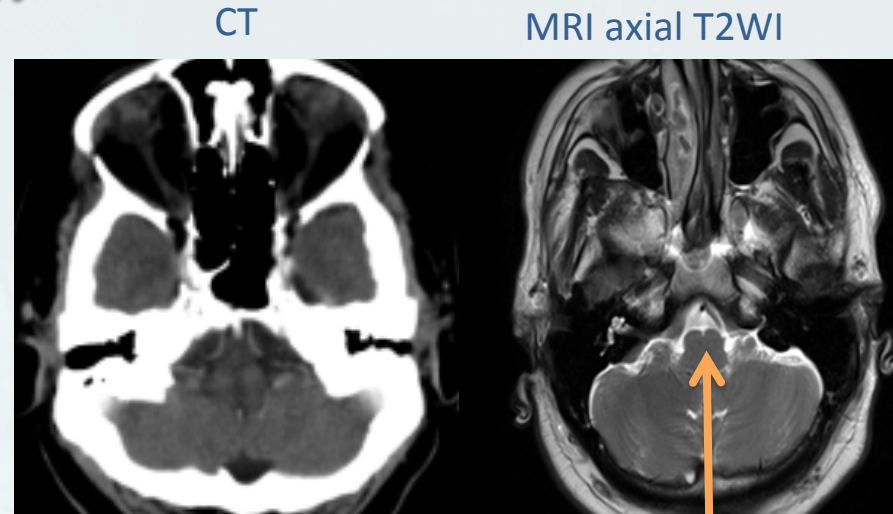
2- basilar artery

3- middle cerebellar peduncle

# □ 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 4<sup>th</sup> ventricle is seen posteriorly

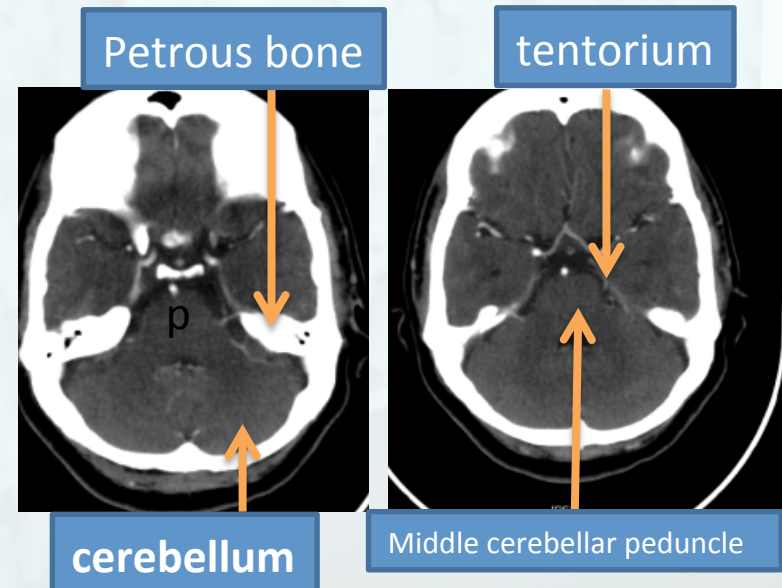


Medulla

# □ Cerebellum:

## Radiological Features:

- On axial Ct & MRI the cerebellum is separated from the pons by the 4<sup>th</sup> ventricle and connected to the pons on each side by middle cerebellar peduncle, it is bounded anteriorly by petrous temporal bone
- On higher slices it is separated from temporal and occipital lobes anterolaterally by tentorial margins, tentorium can be seen on contrast enhanced studies owing to the contained superior petrosal sinus





# □ Cerebellum:

## Radiological Features:

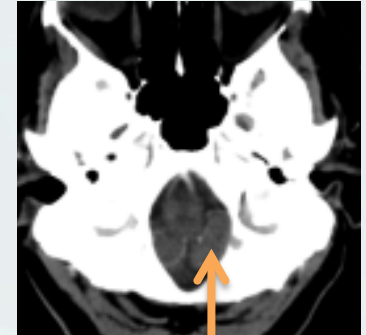
- Cerebellum is connected to the brainstem by three pairs of cerebellum peduncles:  
Superior.....connected to the midbrain  
Middle.....connected to the pons  
inferior.....connected to medulla oblongata
- The two cerebellar hemisphere connected in midline by vermis.
- Flocculus is a small ventral portion 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.

CT



Superior vermis

Axial CT



tonsil

With pressure the tonsils could go through the foramen magnum.

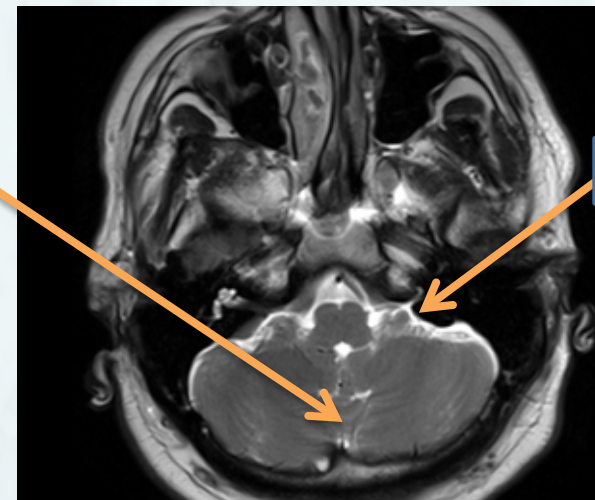
Sagittal MRI T1WI



tonsil

vermis

MRI axial T2WI

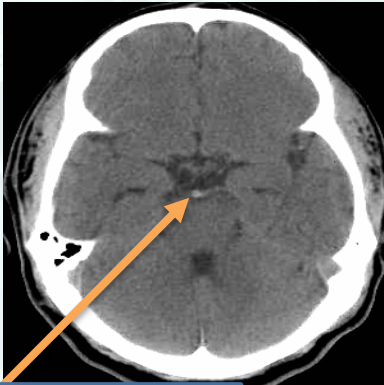


flocculus

# ❑ Common diseases of brainstem & cerebellum:

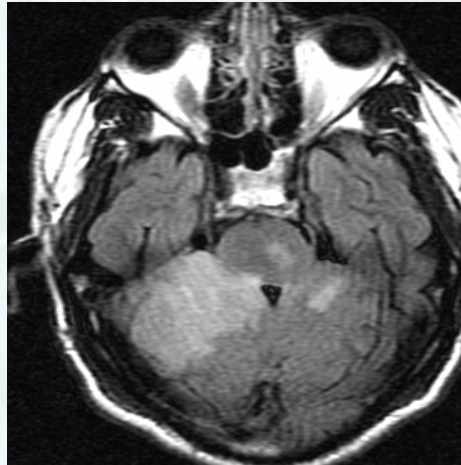
## ✧ Acute infarction due to basilar artery thrombosis

CT



Hyperdense basilar artery

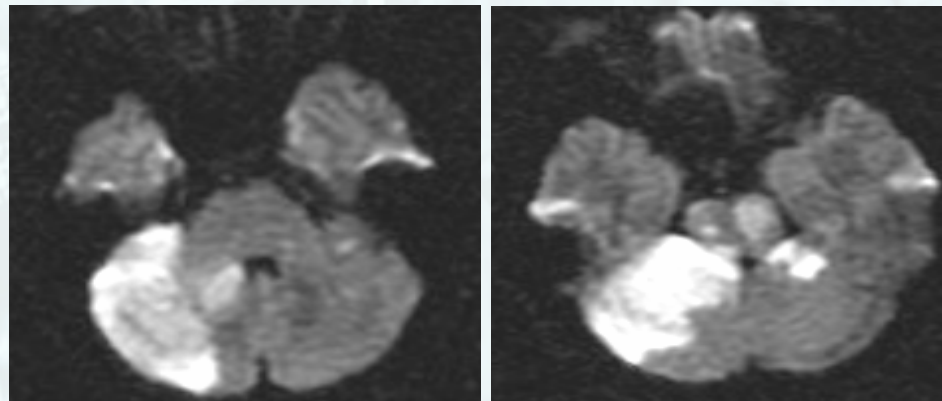
MRI axial FLAIR



MRI axial T2WI



Diffusion sequence



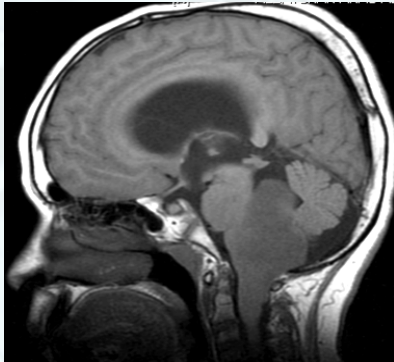


# □ Common diseases of brainstem & cerebellum:

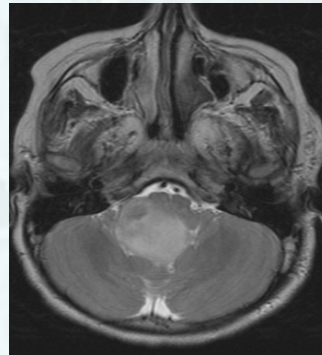
## ✧ Brain stem glioma

(Mass in brain stem particularly medulla oblongata)

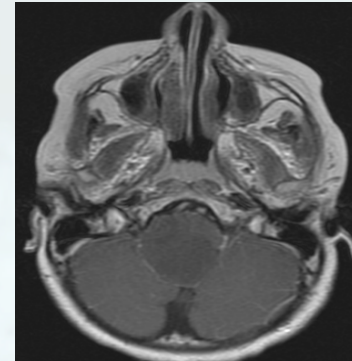
Sagittal MRI T1WI



Axial MRI T2WI



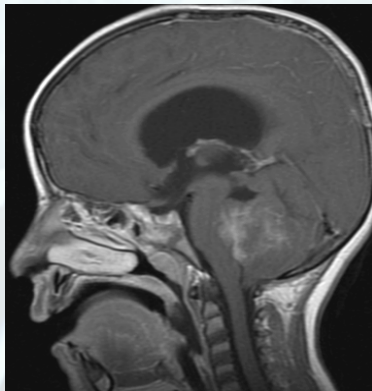
Axial MRI T1WI contrast



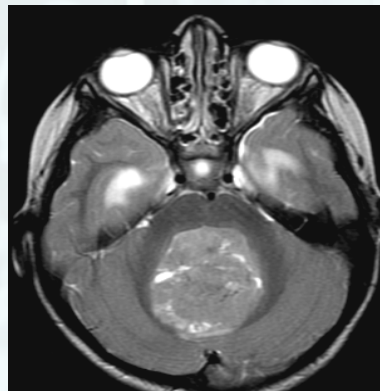
## ✧ Medulloblastoma

(common in children) Mass in the 4<sup>th</sup> ventricle and the midline of cerebellum

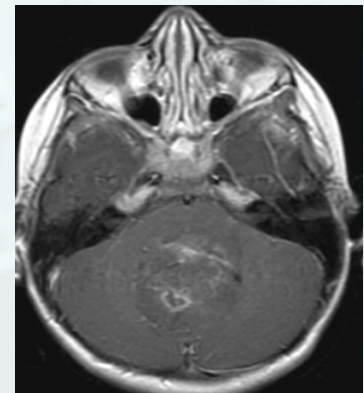
Sagittal MRI T1WI contrast



Axial MRI T2WI



Axial MRI T1WI contrast

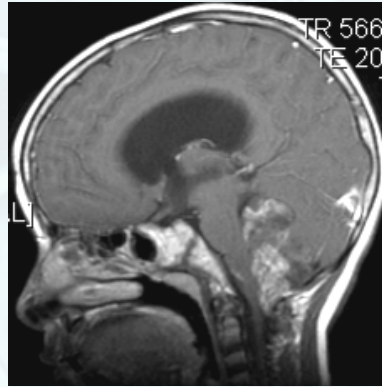


# □ Common diseases of brainstem & cerebellum:

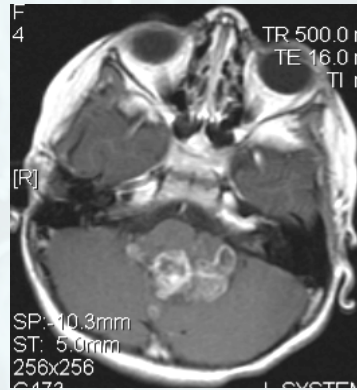
## ✧ Ependymoma

Mass in the 4th ventricle extending through foramen magnum

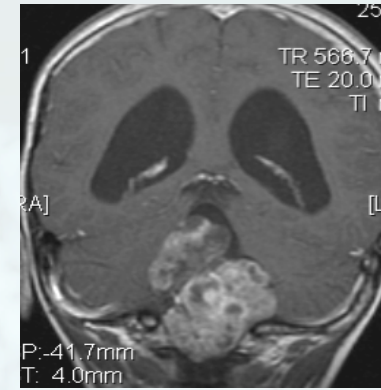
Sagittal MRI T1WI contrast



Axial MRI T1WI contrast



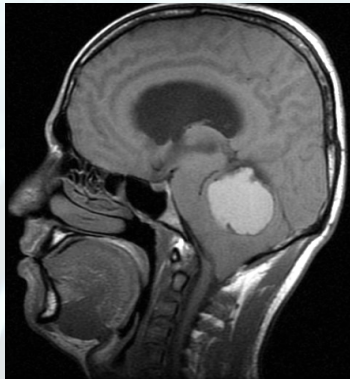
Coronal MRI T1WI contrast



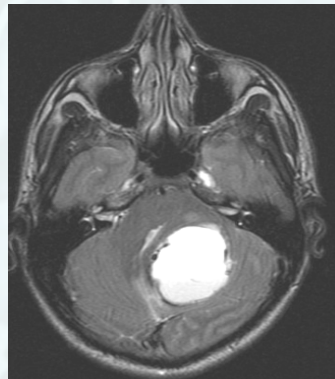
## ✧ Hemangioblastoma

Mass in left cerebellum hemisphere compressing the 4<sup>th</sup> ventricle and tonsils through the foramen magnum

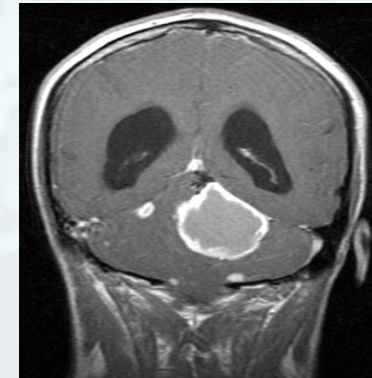
Sagittal MRI T1WI



Axial MRI T2WI



Coronal MRI T1WI contrast



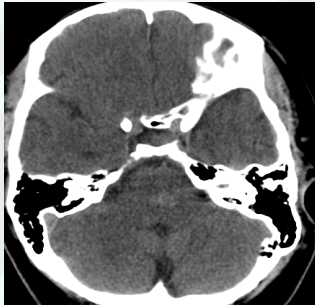


# □ Common diseases of brainstem & cerebellum:

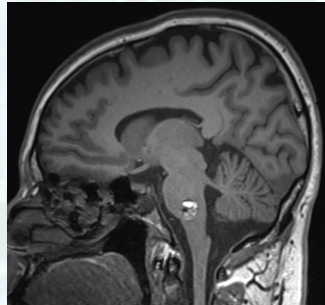
## ✧ Cavernous angioma

(Mass in caudal pons)

CT



Sagittal MRI T1WI



Axial MRI T2WI



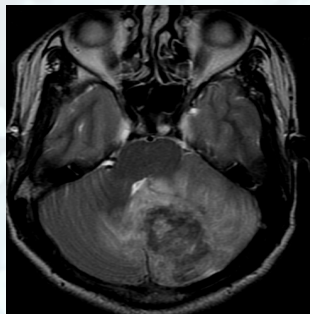
Axial MRI SWI



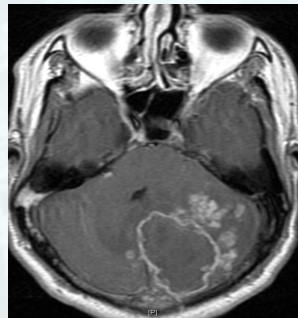
## ✧ Cerebellar tuberculosis

(Tuberculous mass in the left cerebellar hemisphere)

Axial MRI T2WI



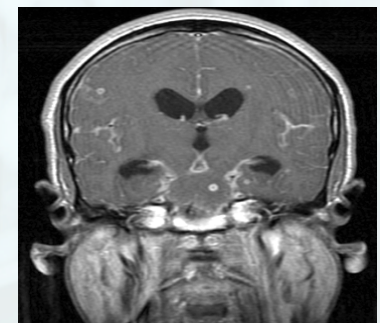
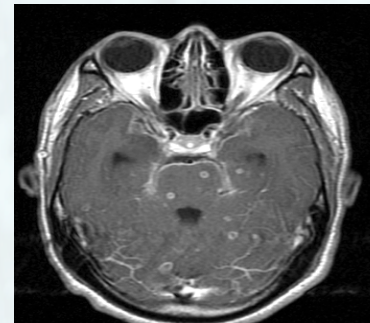
Axial MRI T1 contrast



## ✧ TB meningitis with multiple Tuberculomas

(right frontal brainstem posterior fossa)

Axial MRI T1 contrast



The TB will appear as a circular hole/holes because it's an infection)

# Questions:

Q1- Circle of Willis is present in :

- A- pons
- B- midbrain
- C- cerebellum
- D- medulla oblongata

Q2- Petrous bone indicate the level of :

- A- pons
- B- medulla oblongata
- C- cerebellum
- D- midbrain

Q3- The best choice for medulla oblongata examination is :

- A- MRI
- B- CT
- C- x-Ray
- D- CT Myelogram

Q4- The two important structure that gives lobes in the cerebellum is :

- A- primary fissure + horizontal fissure
- B- primary fissure + pre-pyramidal fissure
- C- pre-pyramidal fissure + horizontal fissure

Answers: 1) B 2) A 3) A 4) B





We really hope that we made it easy and informative ,,

## **Done By :**

Faisal S. ALGhamdi  
Falwah ALHarthi  
Barah ALQarni  
Afnan ALMutawa  
Munira ALMehsen  
Basmah ALDoghaither  
Alanoud ALBogami

## **Revised By :**

Faisal S ALGamdi  
Haifa ALOtaibi

Contact us : [433radiology@gmail.com](mailto:433radiology@gmail.com)