

# Lecture Title:

# BRAIN STEM AND CEREBELLUM

(CNS Block, Radiology)



# Lecture Objectives..



**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.

# Brain Divisions..



- There are three major divisions of the brain:

## I Prosencephalon **Forebrain**

Diencephalon thalamus, hypothalamus

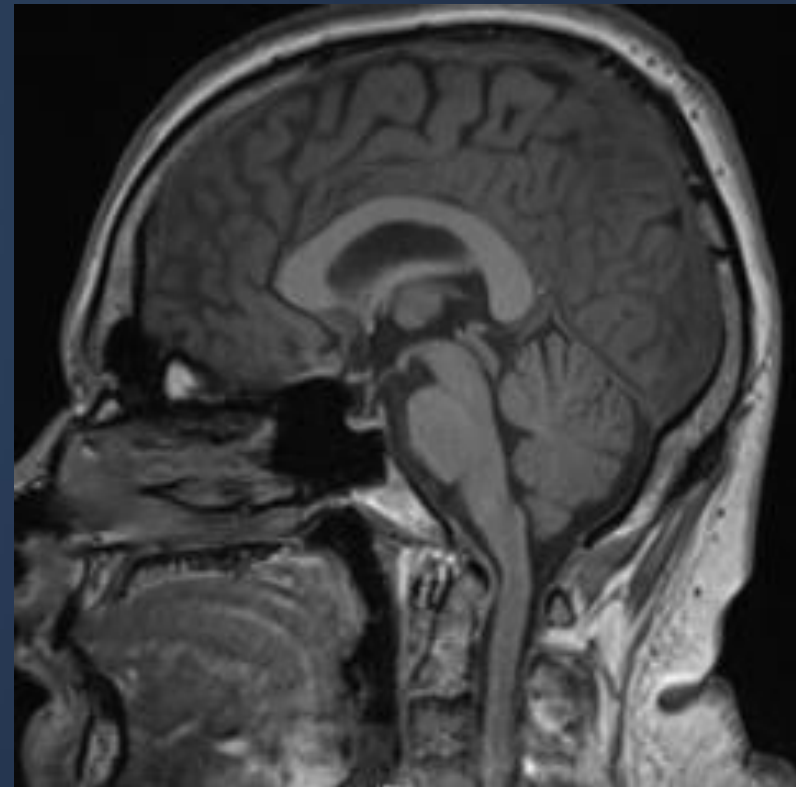
Telencephalon cerebrum

## II Mesencephalon – **Midbrain**

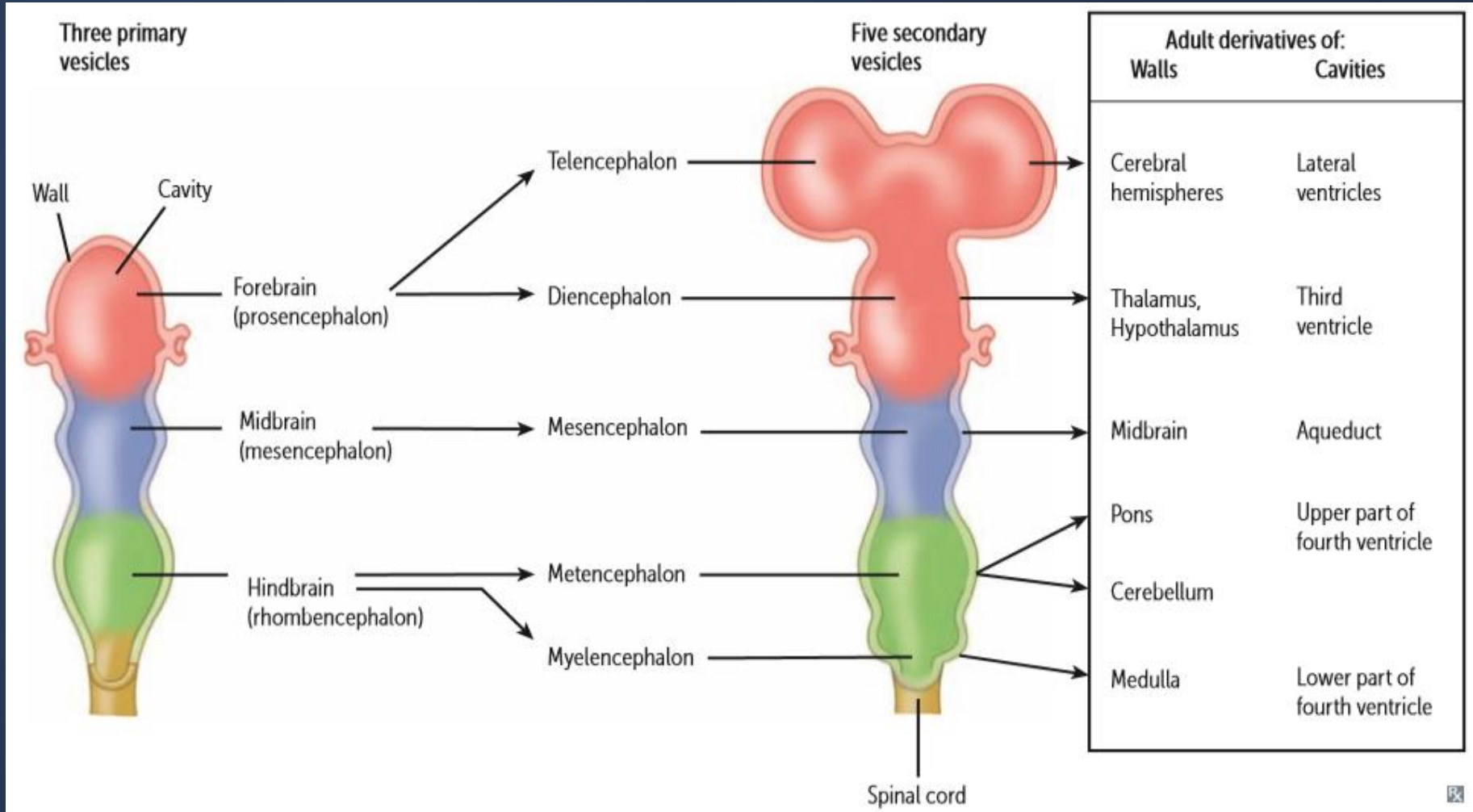
## III Rhombencephalon - **Hindbrain**

Metencephalon pons and cerebellum

Myelencephalon medulla oblongata



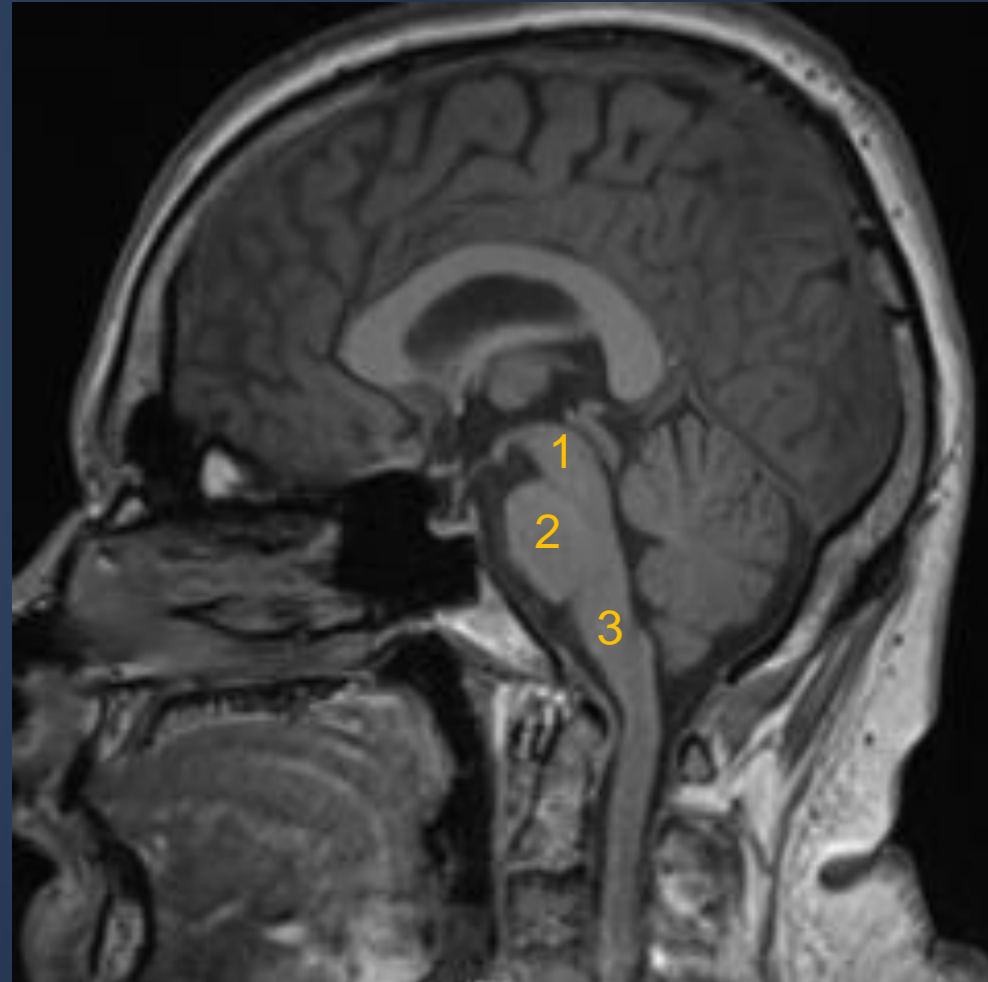
# Brain Divisions..



# Brain Stem..



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

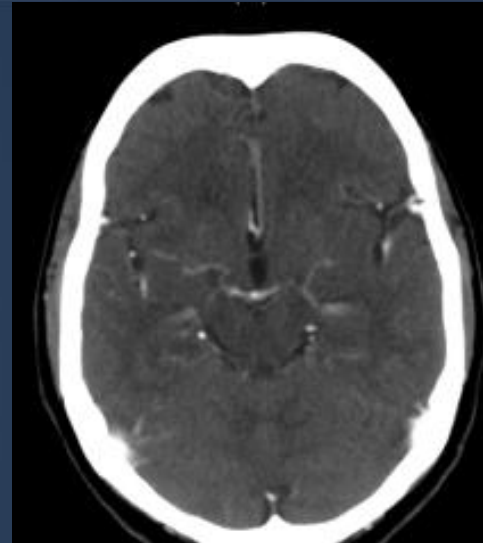


# Midbrain..

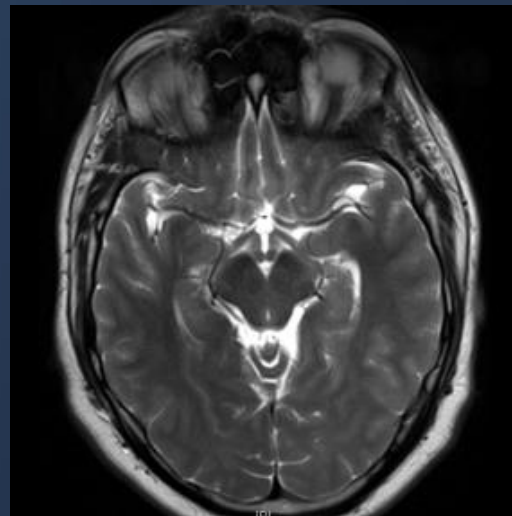


## Radiological Features:

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



CT+

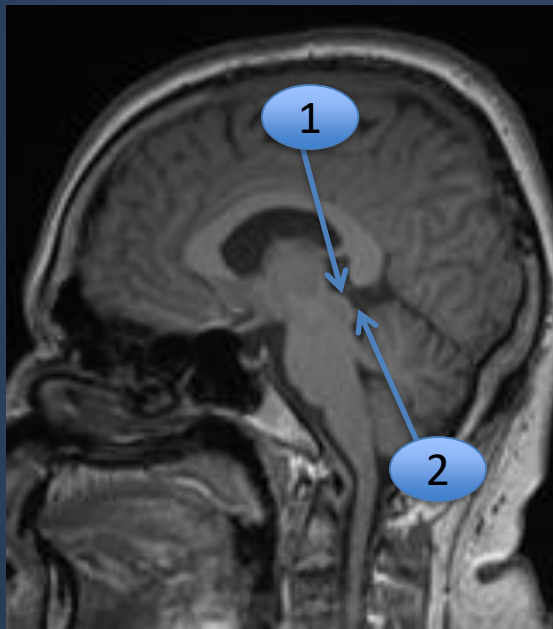


MRI  
T2WI

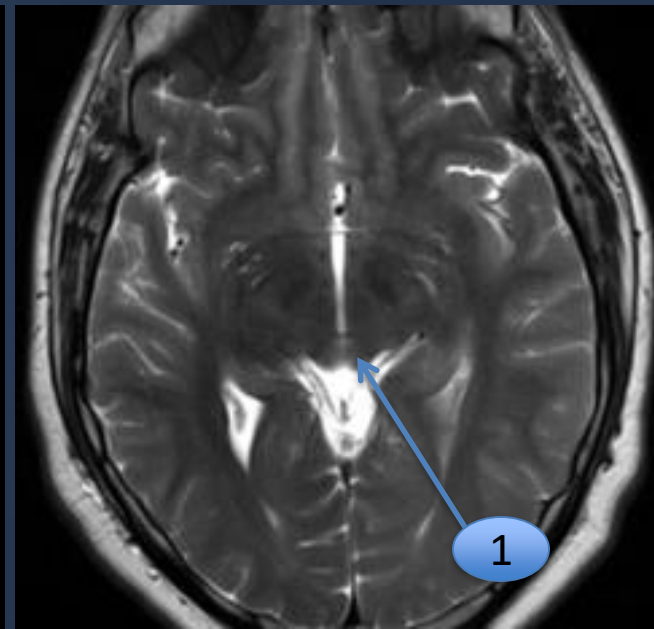
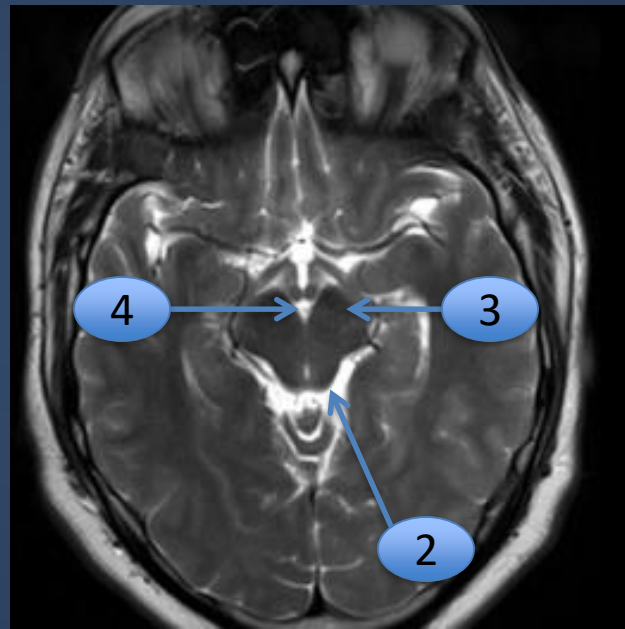


# Midbrain..

MRI Sagittal T1WI



MRI axial T2WI



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

# Midbrain..

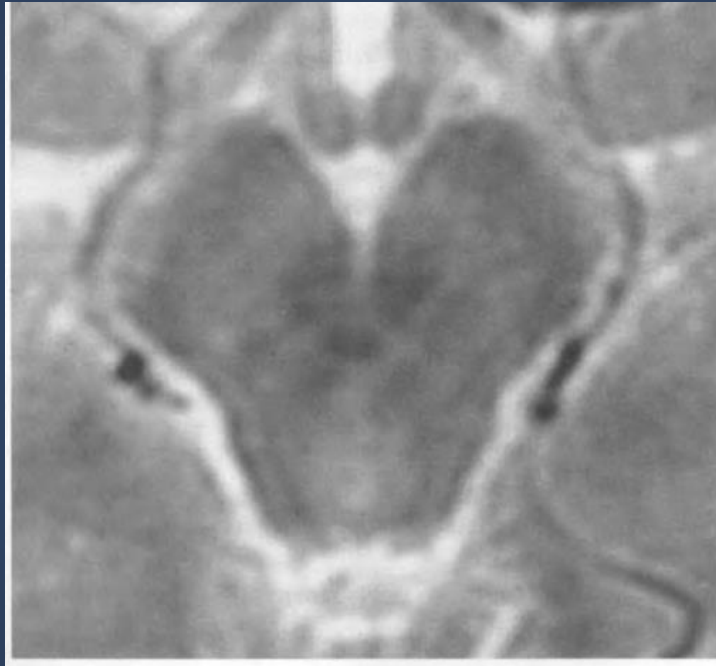
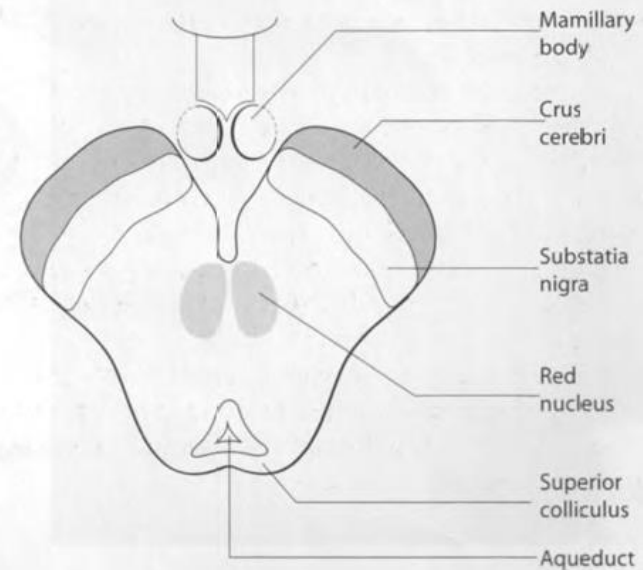


Fig. 2.14 Midbrain, axial section: (a) T<sub>2</sub> MRI; (b) diagram.



## Internal features:

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



# 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
- 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+

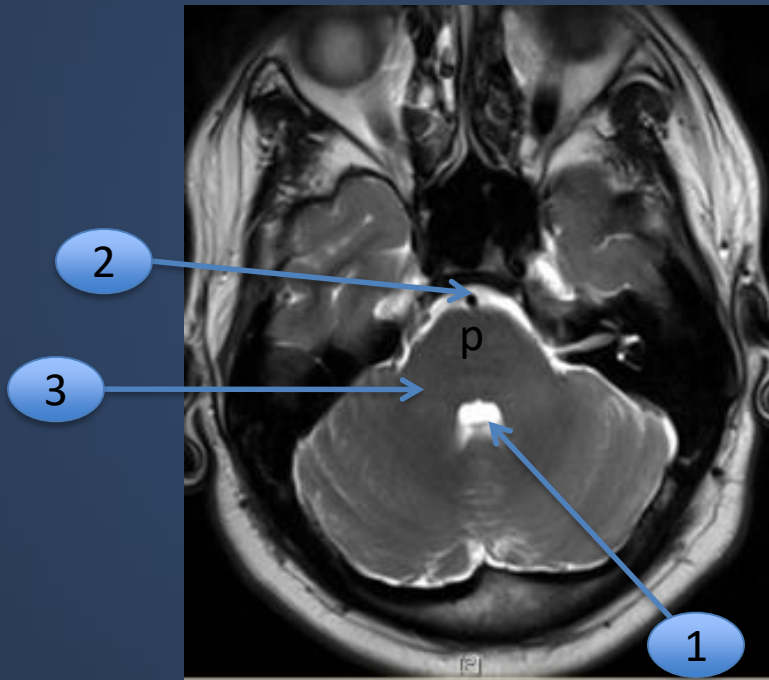
Petrous bone



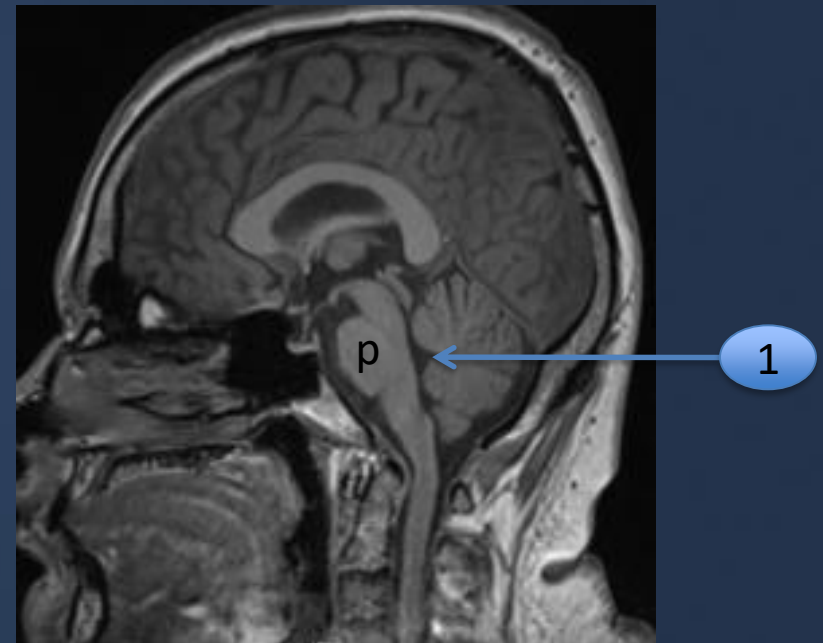
Basilar artery

# Pons..

MRI axial T2WI



MRI Sagittal T1WI



## P pons

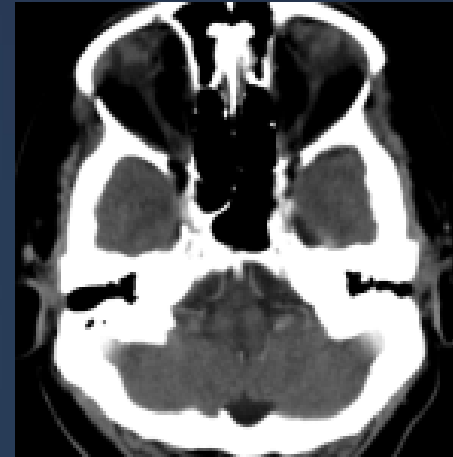
- 1 4<sup>th</sup> ventricle
- 2 basilar artery
- 3 middle cerebellar peduncle

# 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



CT+



MRI axial  
T2WI

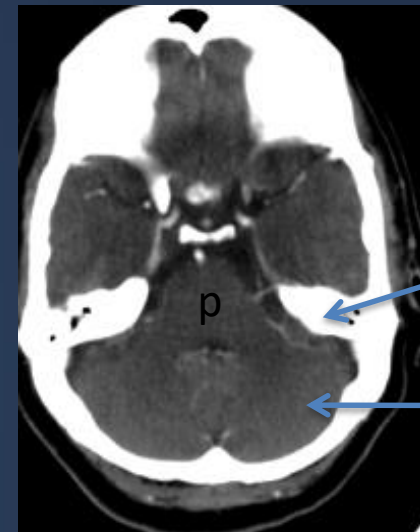
medulla

# Cerebellum..



## Radiological Features:

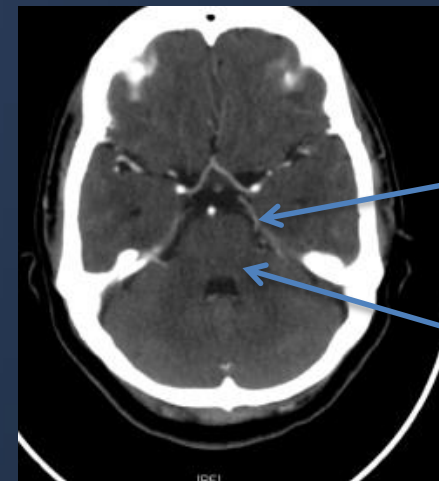
- On axial Ct & MRI the cerebellum is separated from the pons by the 4<sup>th</sup> ventricle and connected to the pons on each side by middle cerebellar peduncle, it is bounded anteriorly by petrous temporal bone
- On higher slices it is separated from temporal and occipital lobes anterolaterally by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



CT+

Petrous bone

cerebellum



tentorium

Middle cerebellar peduncle

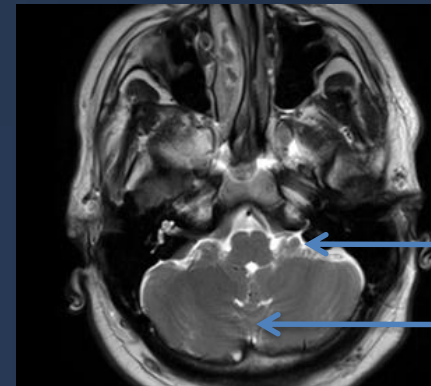
# Cerebellum..



## 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
- 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

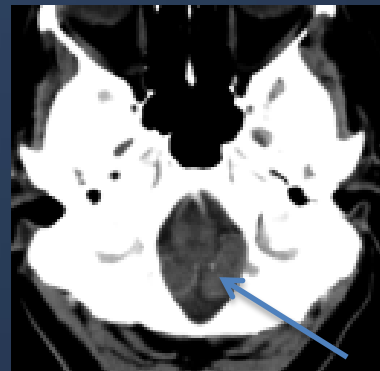
MRI axial T2WI



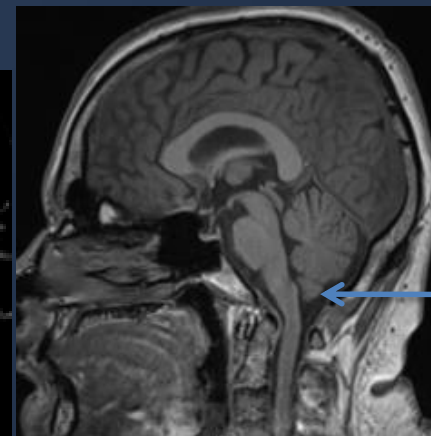
flocculus

vermis

axial CT



tonsil



tonsil

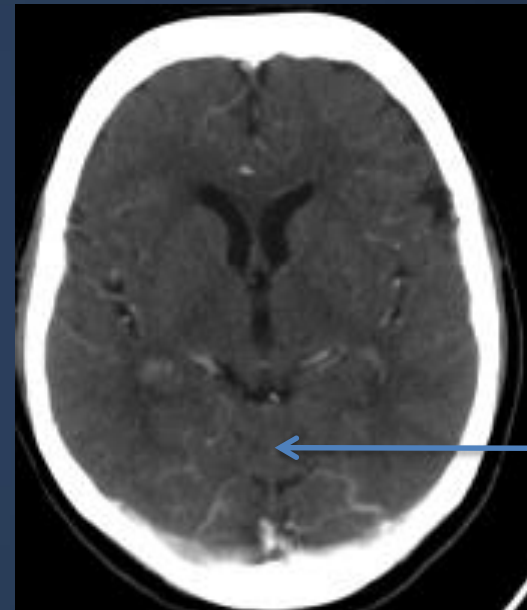
MRI sagittal T1WI

# Cerebellum..



## Radiological Features:

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



CT+

Superior vermis



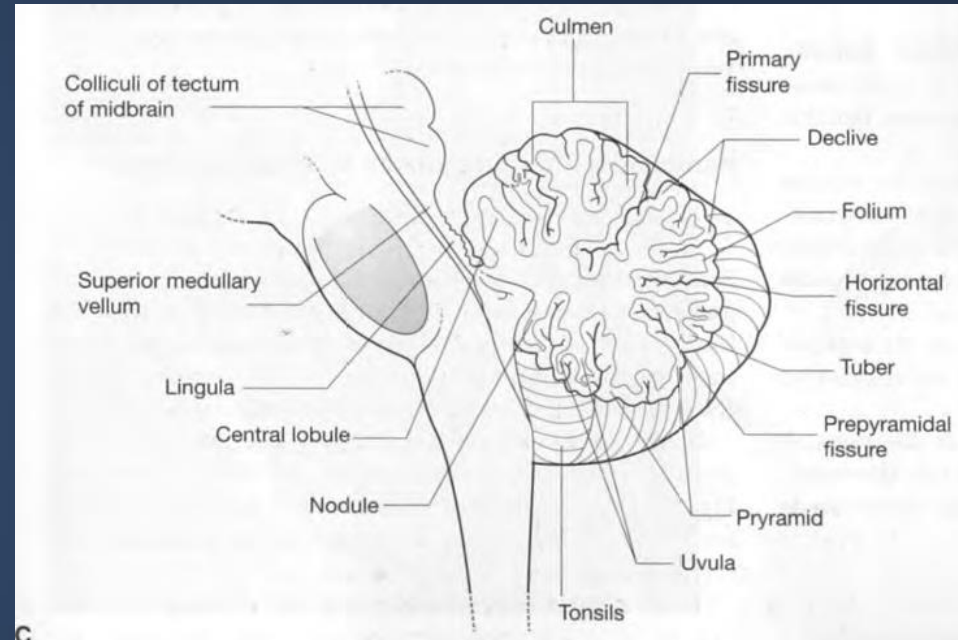
# Cerebellum..



Fig. 2.16 Midline sagittal T<sub>2</sub> 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

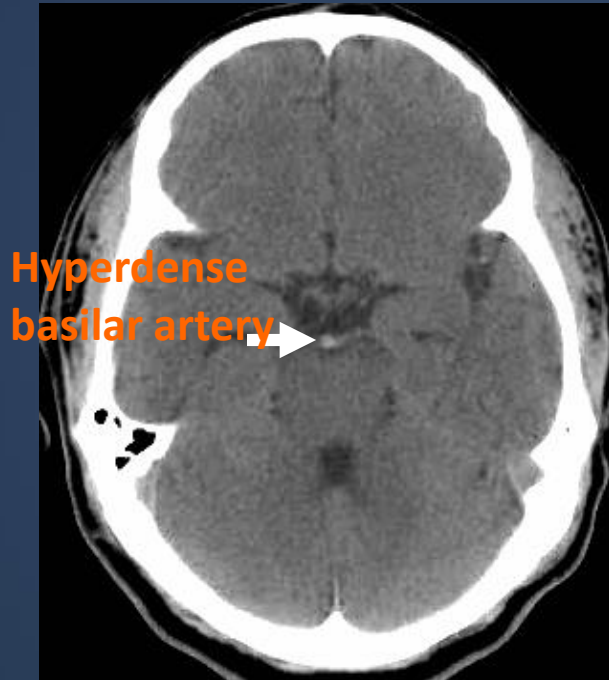


## Cerebellar Vermis

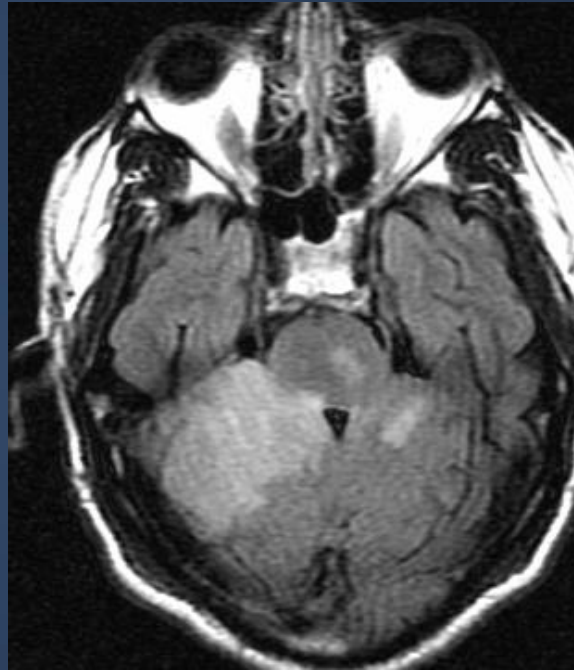
# Common diseases of brainstem & cerebellum..



CT



MRI axial FLAIR

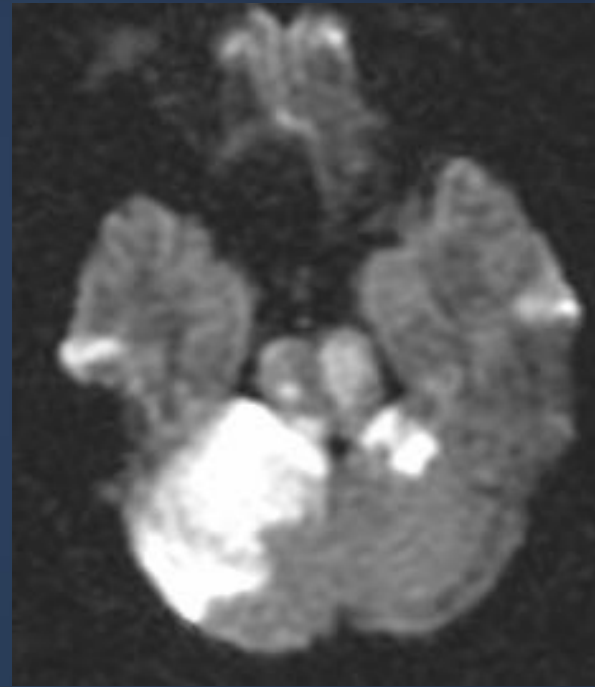
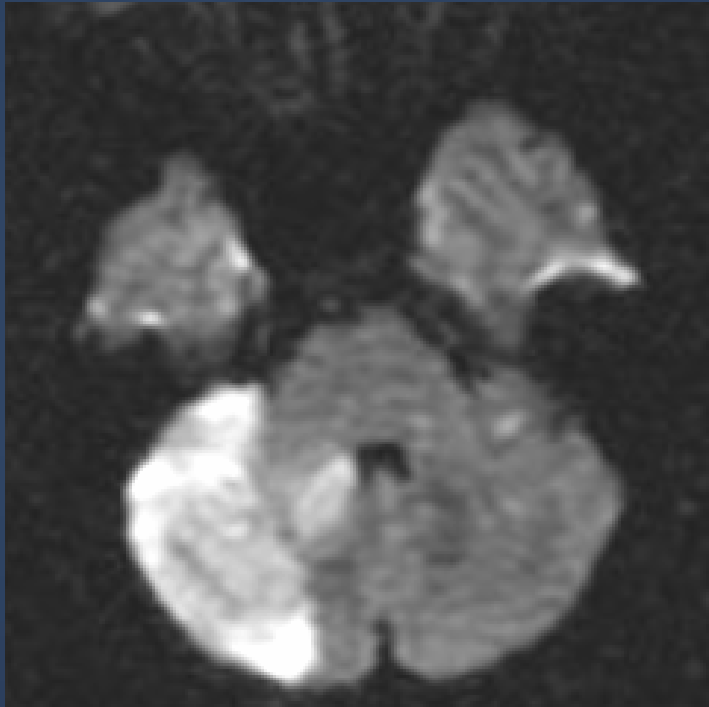


MRI axial T2WI



Acute infarction due to  
basilar artery thrombosis

# Common diseases of brainstem & cerebellum..



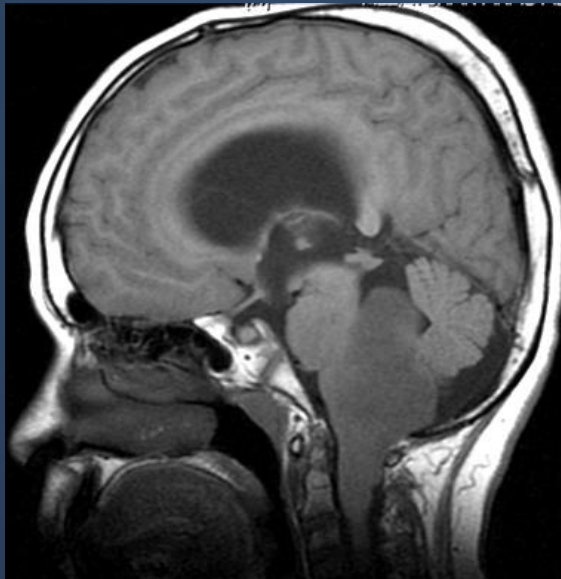
**Diffusion sequence**

**Acute infarction due to  
basilar artery thrombosis**

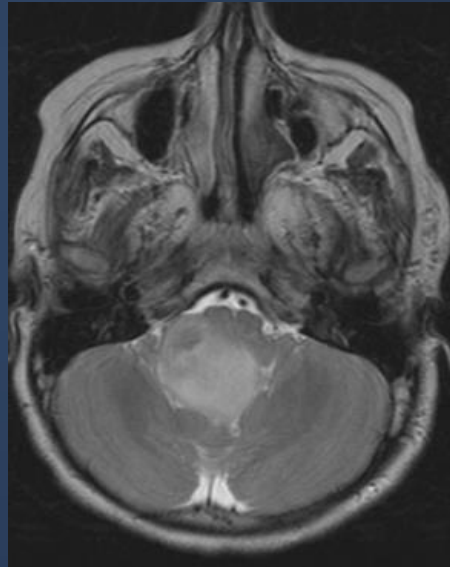
# Common diseases of brainstem & cerebellum..



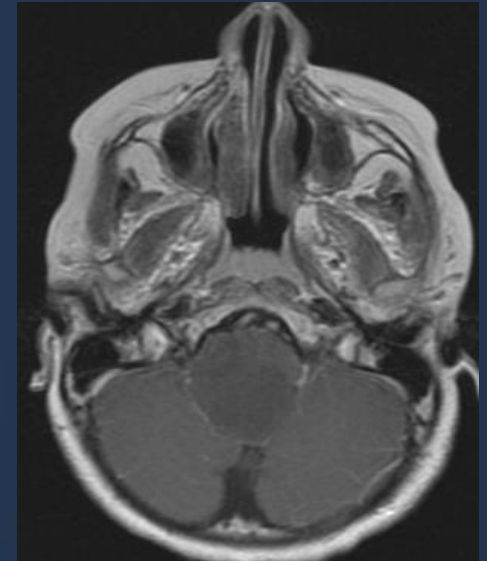
Sag MRI T1WI



axial MRI T2WI



axial MRI T1WI contrast

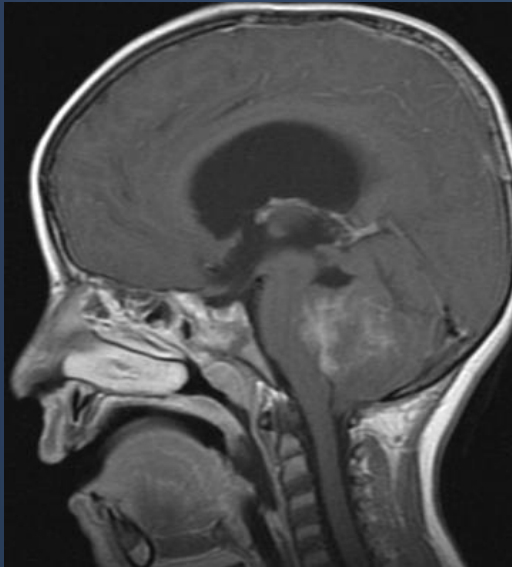


## Brain stem glioma

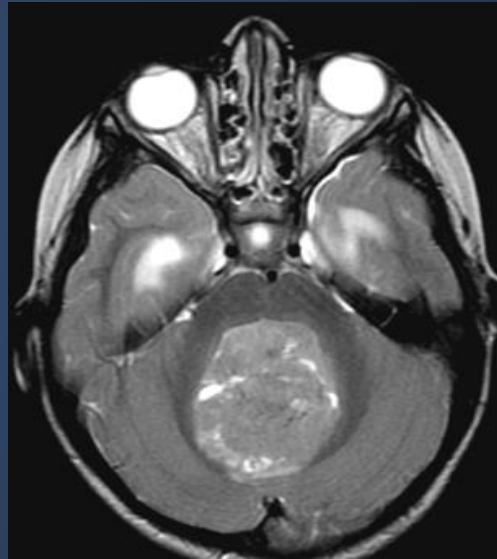
# Common diseases of brainstem & cerebellum..



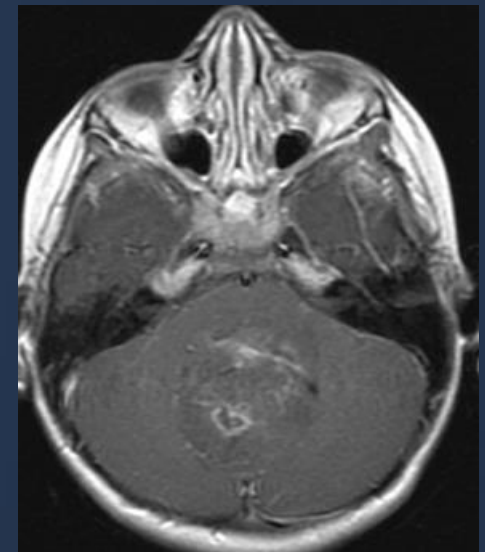
Sag MRI T1WI contrast



axial MRI T2WI



axial MRI T1WI contrast



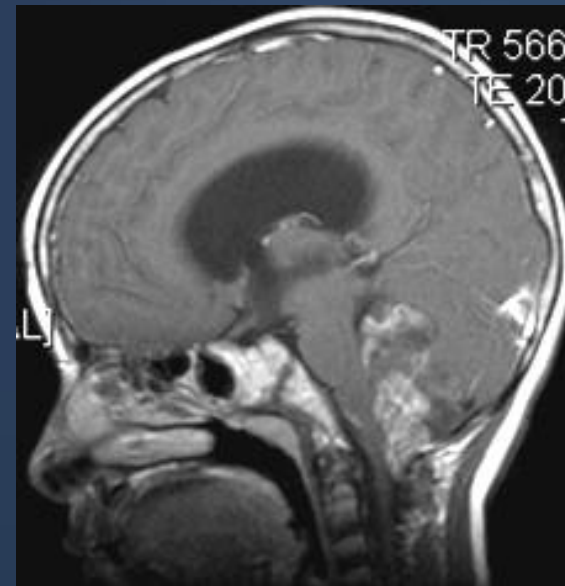
## Medulloblastoma



# Common diseases of brainstem & cerebellum..



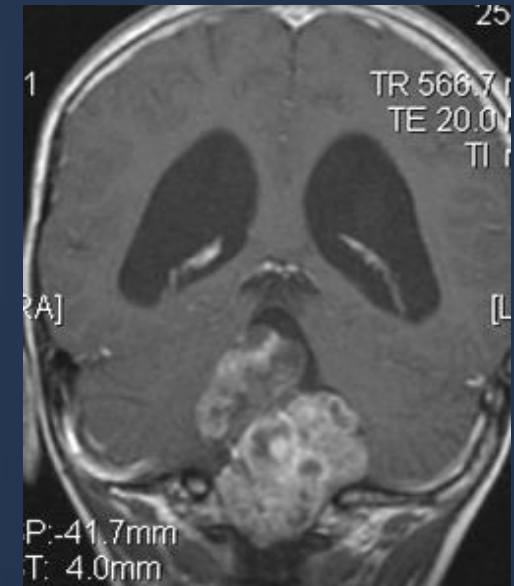
Sag MRI T1WI contrast



axial MRI T1WI contrast



Coronal MRI T1WI contrast



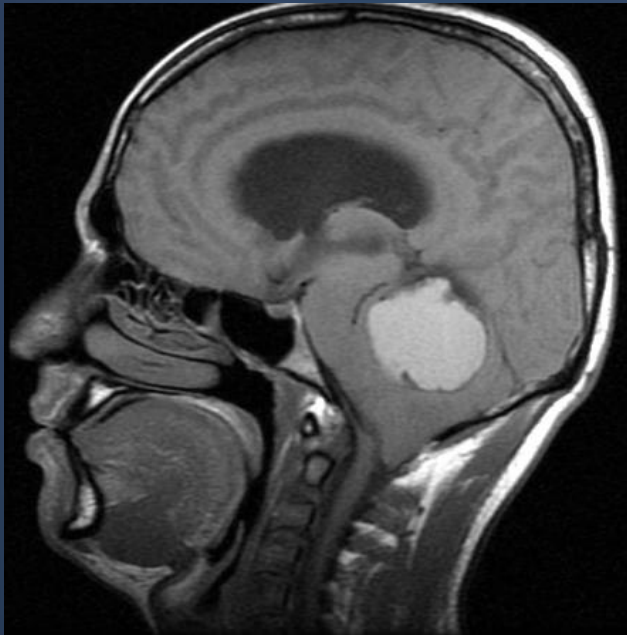
## Ependymoma



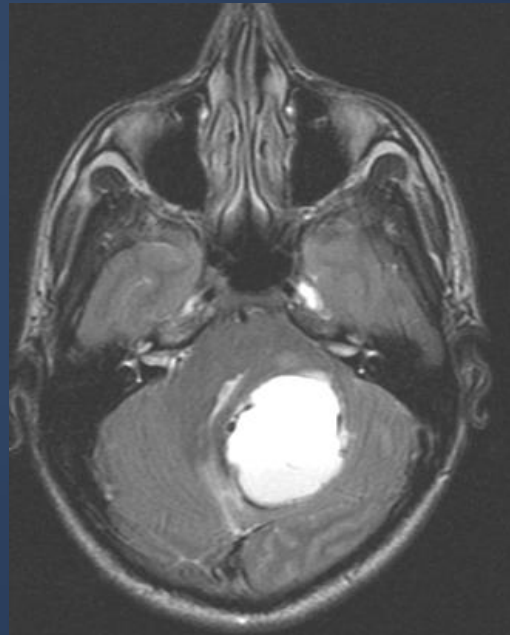
# Common diseases of brainstem & cerebellum..



Sag MRI T1WI



axial MRI T2WI



Coronal MRI T1WI contrast



## Hemangioblastoma

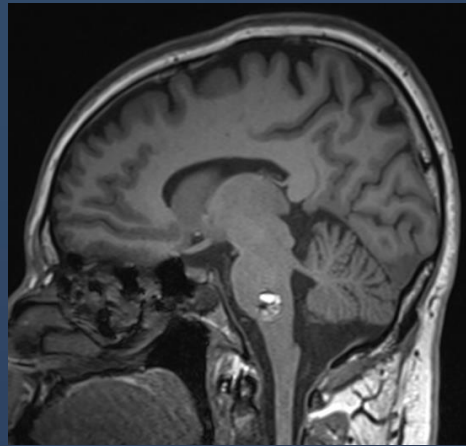
# Common diseases of brainstem & cerebellum..



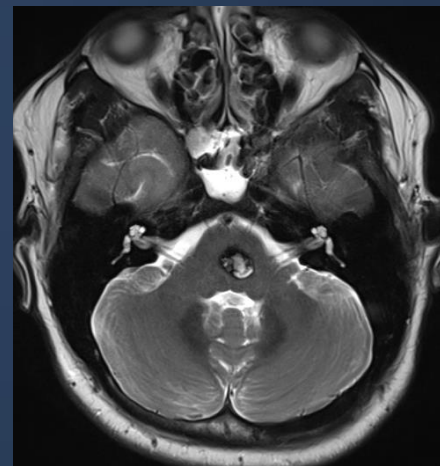
CT



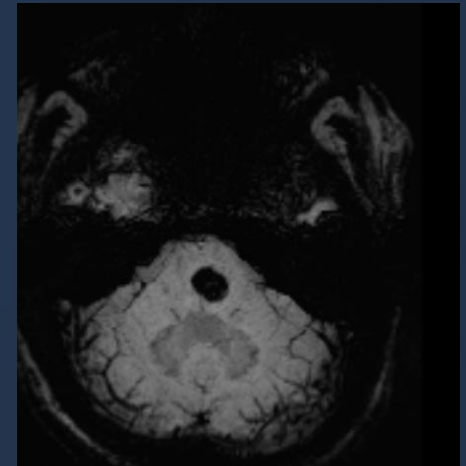
Sag MRI T1WI



axial MRI T2WI



axial MRI SWI

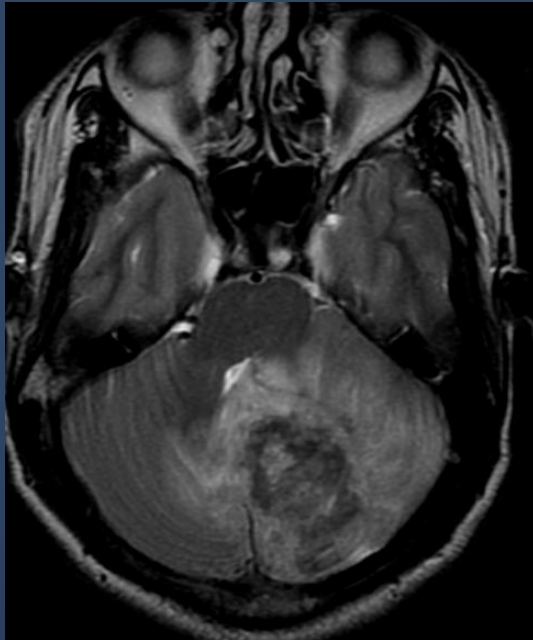


## Cavernous angioma

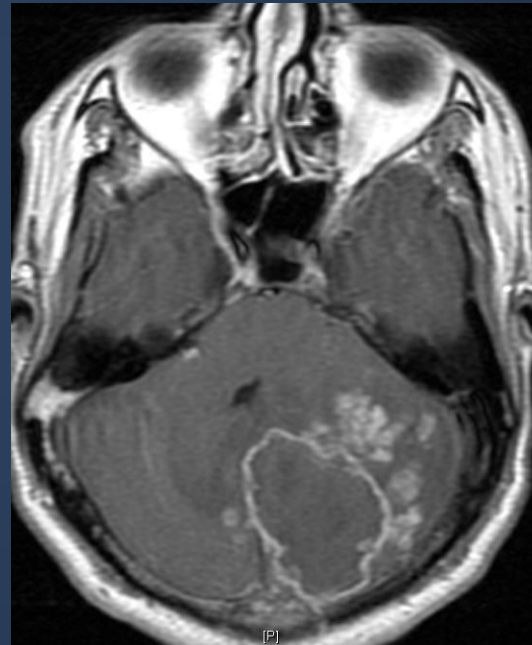
# Common diseases of brainstem & cerebellum..



axial MRI T2WI



axial MRI T1 contrast

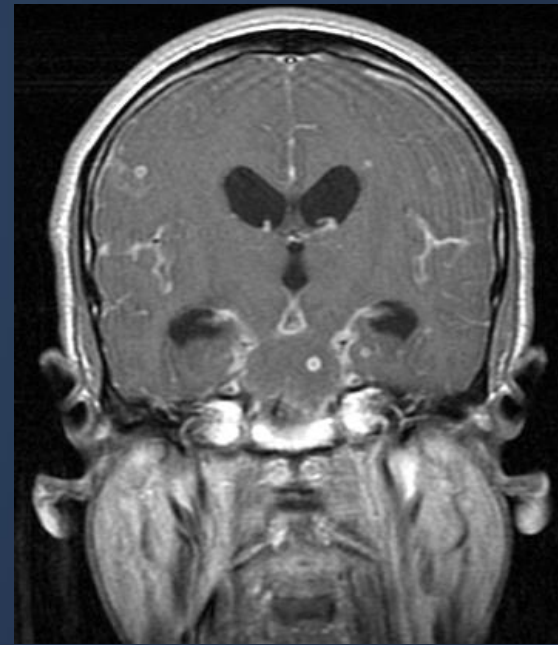
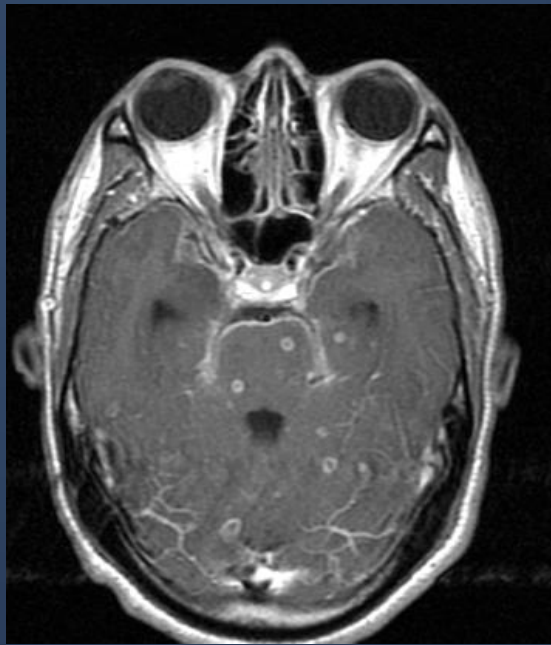


## Cerebellar tuberculosis

# Common diseases of brainstem & cerebellum..



axial MRI T1 contrast

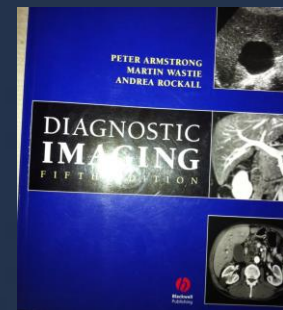
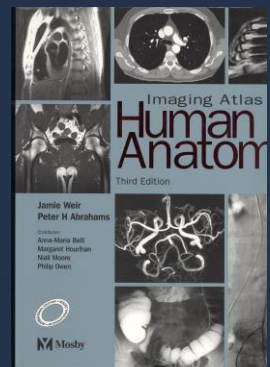
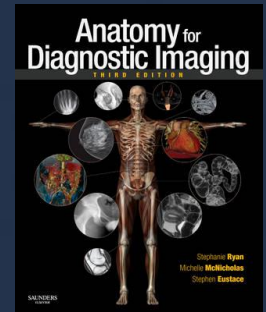


**TB meningitis with multiple tuberculomas**

# Reference book and the relevant page numbers..



- Stephanie Ryan, “Anatomy for Diagnostic imaging”, 2<sup>nd</sup> Edition, Pages 61-66
- Jamie Weir, Peter Abraham, “Imaging Atlas of Human Anatomy” 3rd Edition, Pages 34-41
- Peter Armstrong, “diagnostic imaging”, 5<sup>th</sup> Edition, Pages (396-404)





# Thank You 😊

(CNS Block, Radiology)

