anatomy of cranial contents

Radiological anatomy

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Radiological anatomy of cranial contents: Magnetic Resonance Imagining :

A brain MRI is one of the most commonly performed techniques of medical imaging. It enables clinicians to focus on various parts of the brain and examine their anatomy and pathology, using different MRI sequences, such as T1w, T2w, or FLAIR.

MRI is used to analyze the anatomy of the brain and to identify some pathological conditions such as cerebrovascular incidents, demyelinating and neurodegenerative diseases. Moreover, the MRI can be used for examining the activity of the brain under specific activities (functional MRI - fMRI). The biggest advantage of MRI is that it uses **no radiation**. However, it takes longer to be produced than CT for example, which is why it's not a primary imaging choice for urgent conditions

The most frequently used MRI sequences for the brain examination are T1-weighted and T2-weighted, as well as FLAIR.

T1w sequences are very useful to examine the normal anatomy of the brain,

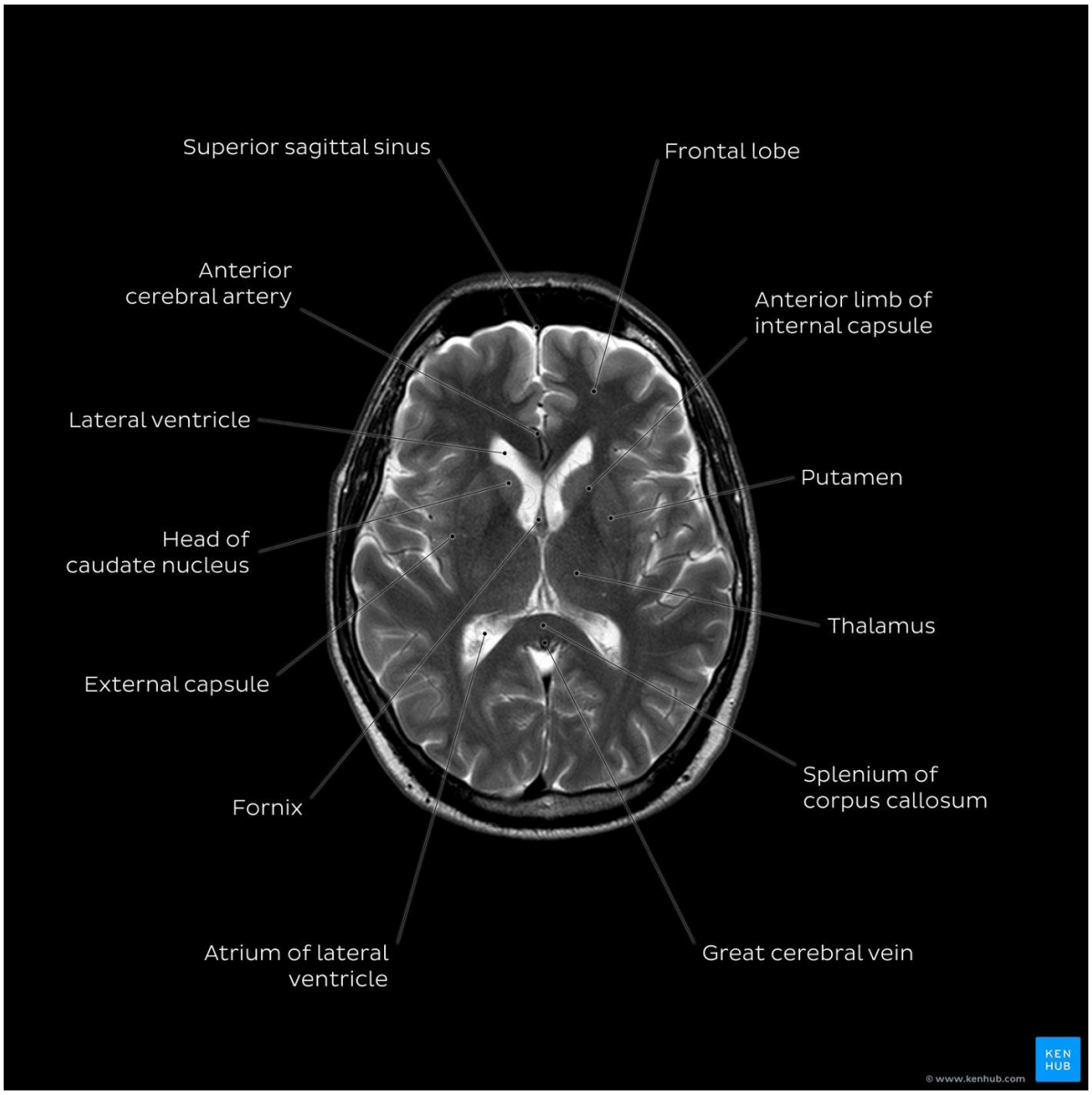
T2w is mostly used to detect the pathological changes in the neural tissue. This is due to the specific characteristics of these sequences;

The T1w sequence shows best the structures that are mostly made of fat. So it shows the cerebrospinal fluid (CSF) as black, gray matter as gray, white matter as white, the bones as black, and the adipose tissue as white.

The T2w best shows the structures with a high amount of water. In this sequence, the CSF is white, gray matter is gray, white matter is darker gray, the bones are black and the adipose tissue is white.

How to read brain MRI:

Brain MRI examination should follow a systematic approach starting from the midline and going laterally. Thus, the brain MRI analysis shall start from the ventricles, going to the surrounding subcortical structures, brain lobes, cerebral cortex, to the meninges and skull.



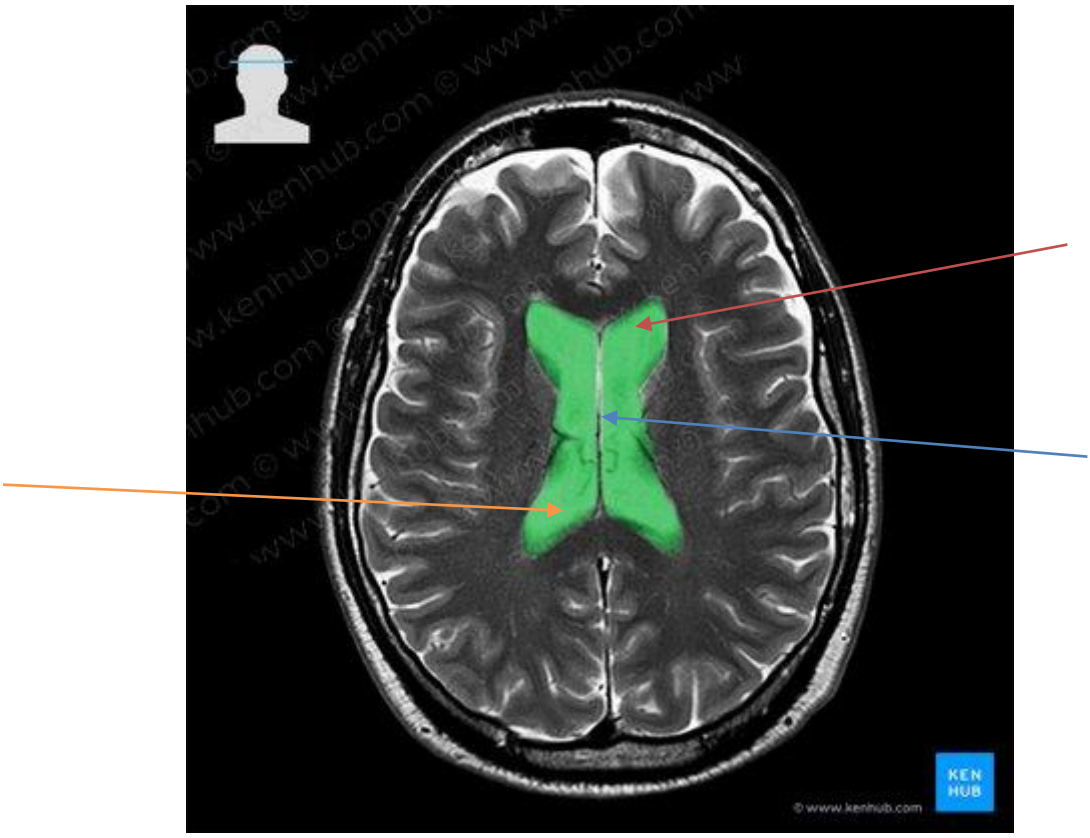
Lateral ventricles:

The lateral ventricles are the two irregularly shaped cavities located on either side of the midline of the brain. They are the most prominent structures on the majority of the axial brain scans. Like the entire ventricular system, they are seen as hyperintense structures on T2w as they contain a lot of fluid (cerebrospinal fluid). Each lateral ventricle is a complex three-dimensional structure, consisting of

a frontal horn(red)

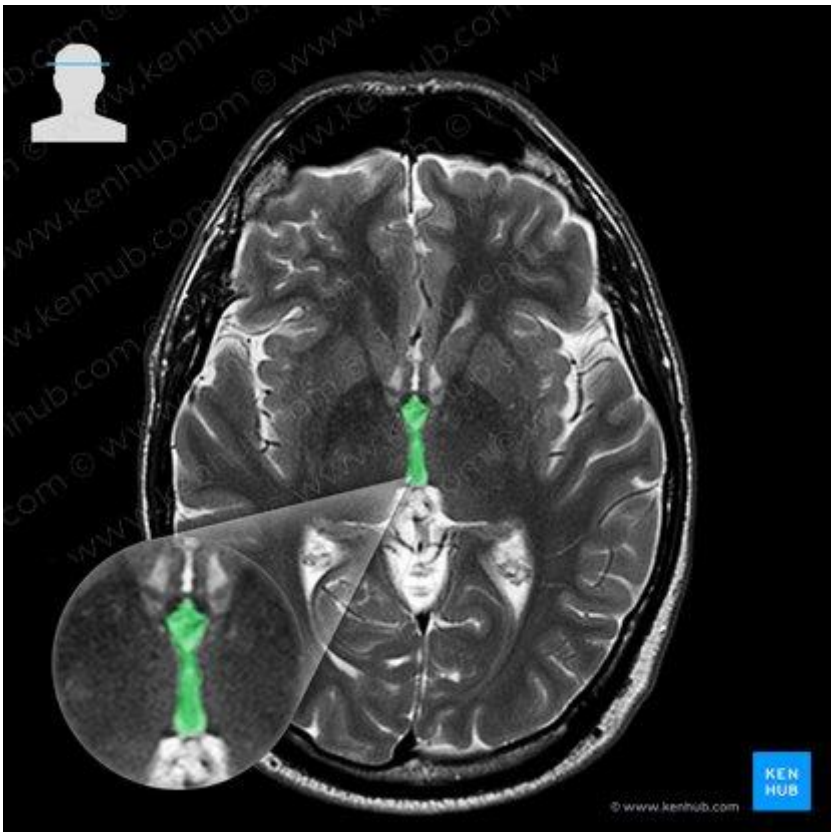
body(blue)

occipital and temporal horns(orang).



The third ventricle:

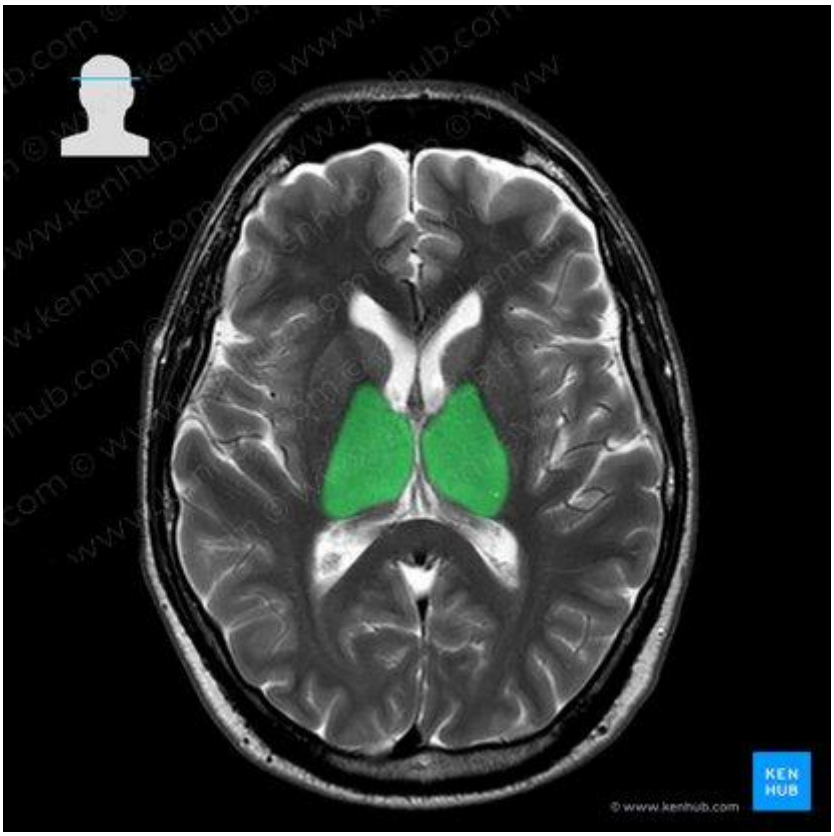
The third ventricle is located between the thalami and below the fornix of the brain. It is normally seen as a slit-like hyperintense structure on the axial brain MRI. It communicates with the lateral ventricles through the foramina of Monro (anteriorly), and with the fourth ventricle via the aqueduct of Sylvius (posteriorly).



Thalamus and basal ganglia:

Going lateral from the ventricles, the next set of structures are the sub cortical structures; thalamus and basal ganglia.

On the axial MRI brain scan, the thalamus is seen as a dark gray ovoid mass, found immediately lateral to the third ventricle and deep to the lateral ventricle.



Brain lobes

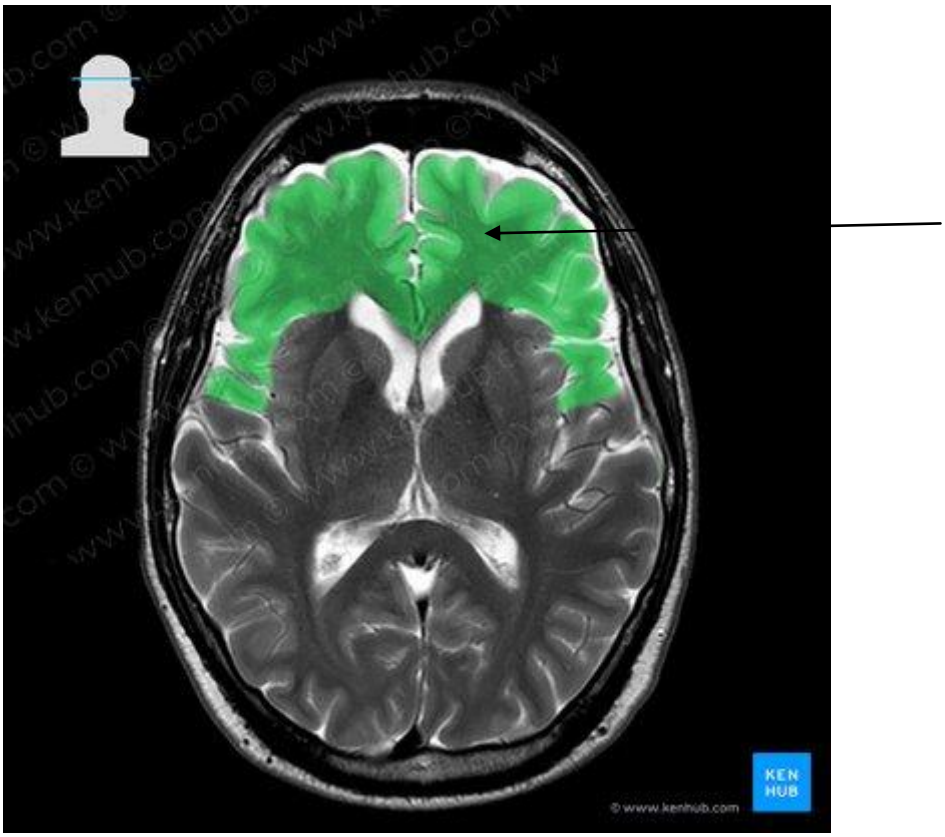
There are six lobes of the brain

frontal, temporal, limbic, parietal, insular and occipital lobes. The insular and limbic lobes are the ones of particular interest in the brain MRI.

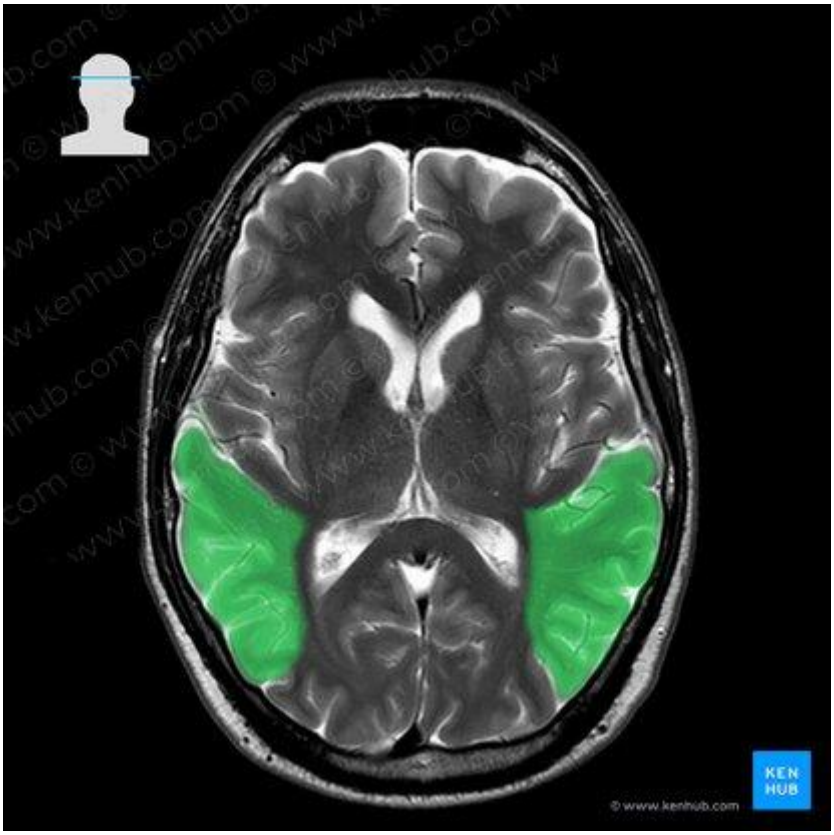
The insular lobe lies just lateral to the extreme capsule of basal ganglia. It is a small portion of the

cerebral cortex found deep to the meeting point of the frontal, temporal and parietal lobes.

The limbic lobe lies deep to the parietal and frontal lobes. It is a functional unit often referred to as the limbic system.

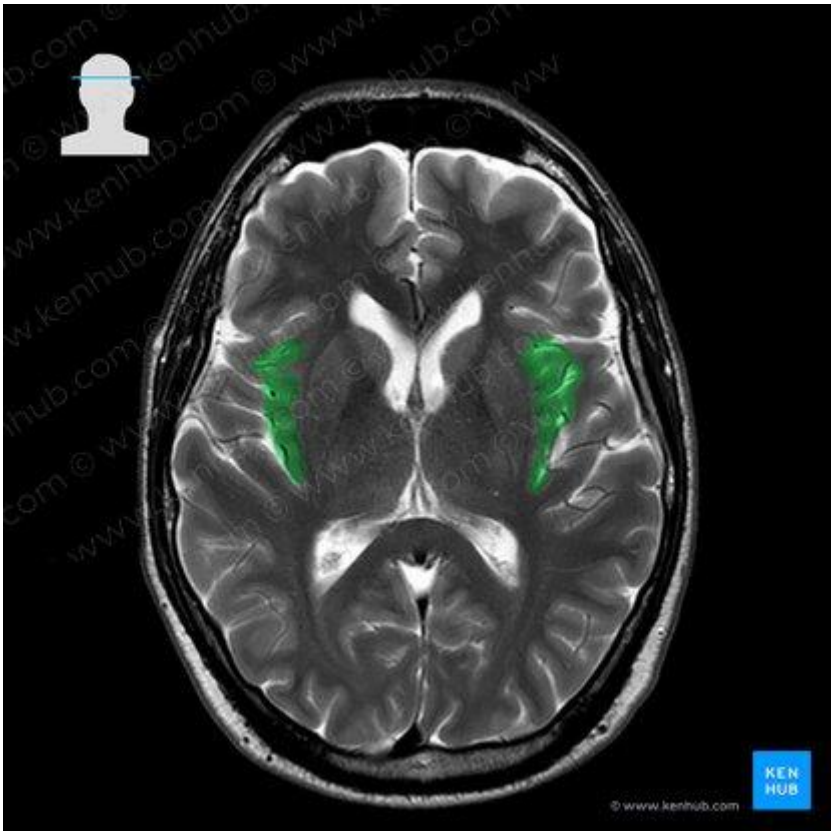


Frontal lobes

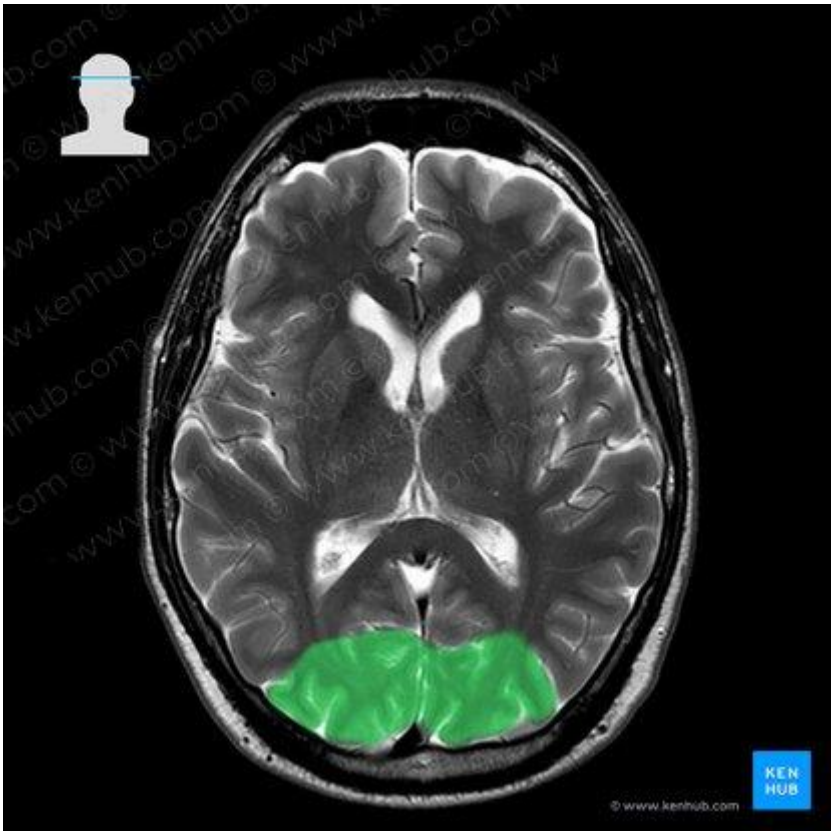


Temporal

Parietal



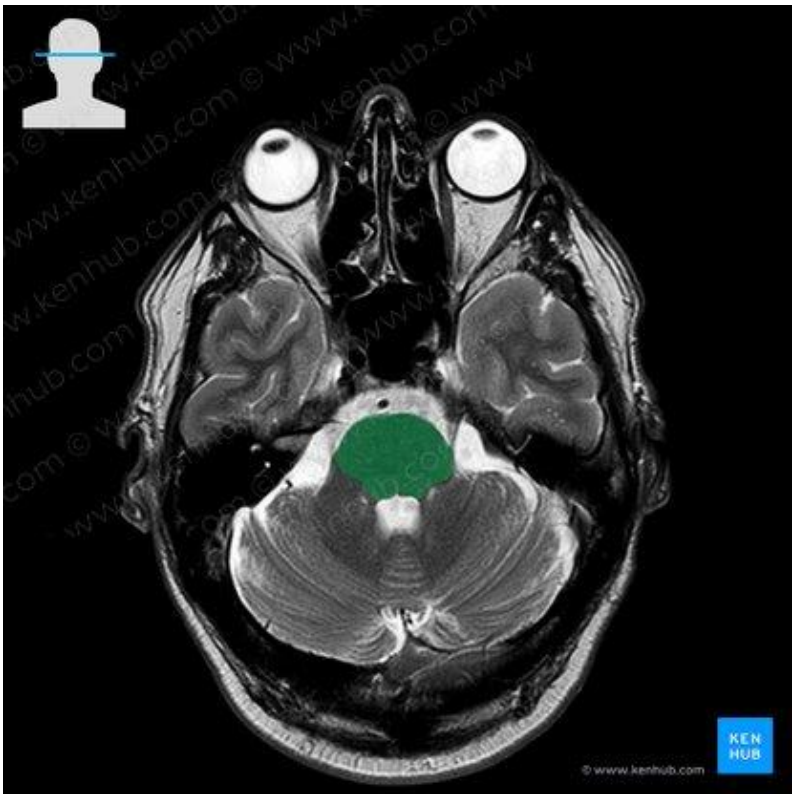
Insular lobe



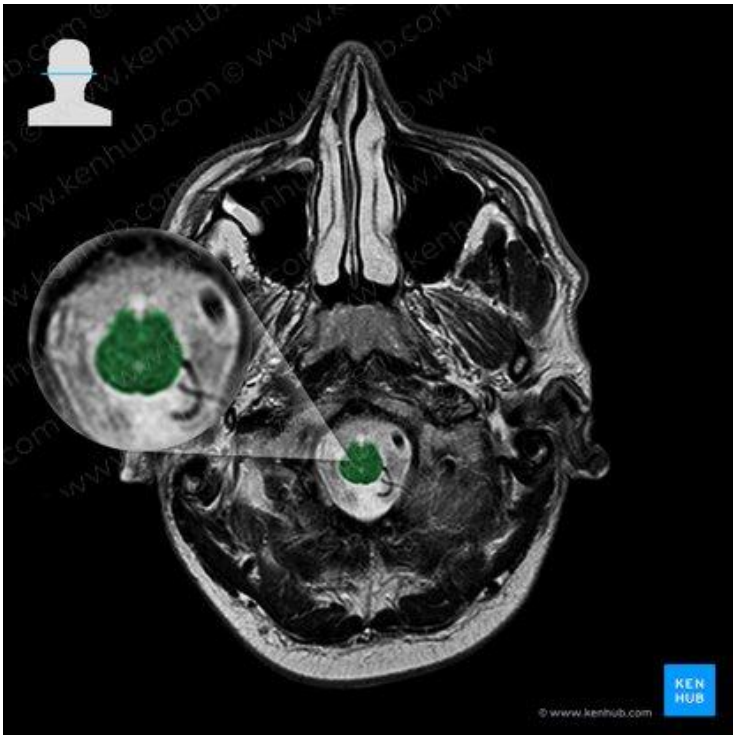
Occipital

The brainstem

The brainstem is the distal part of the brain that extends from the base of the brain to the spinal cord. From superior to inferior, the brainstem consists of the midbrain, pons and medulla oblongata.



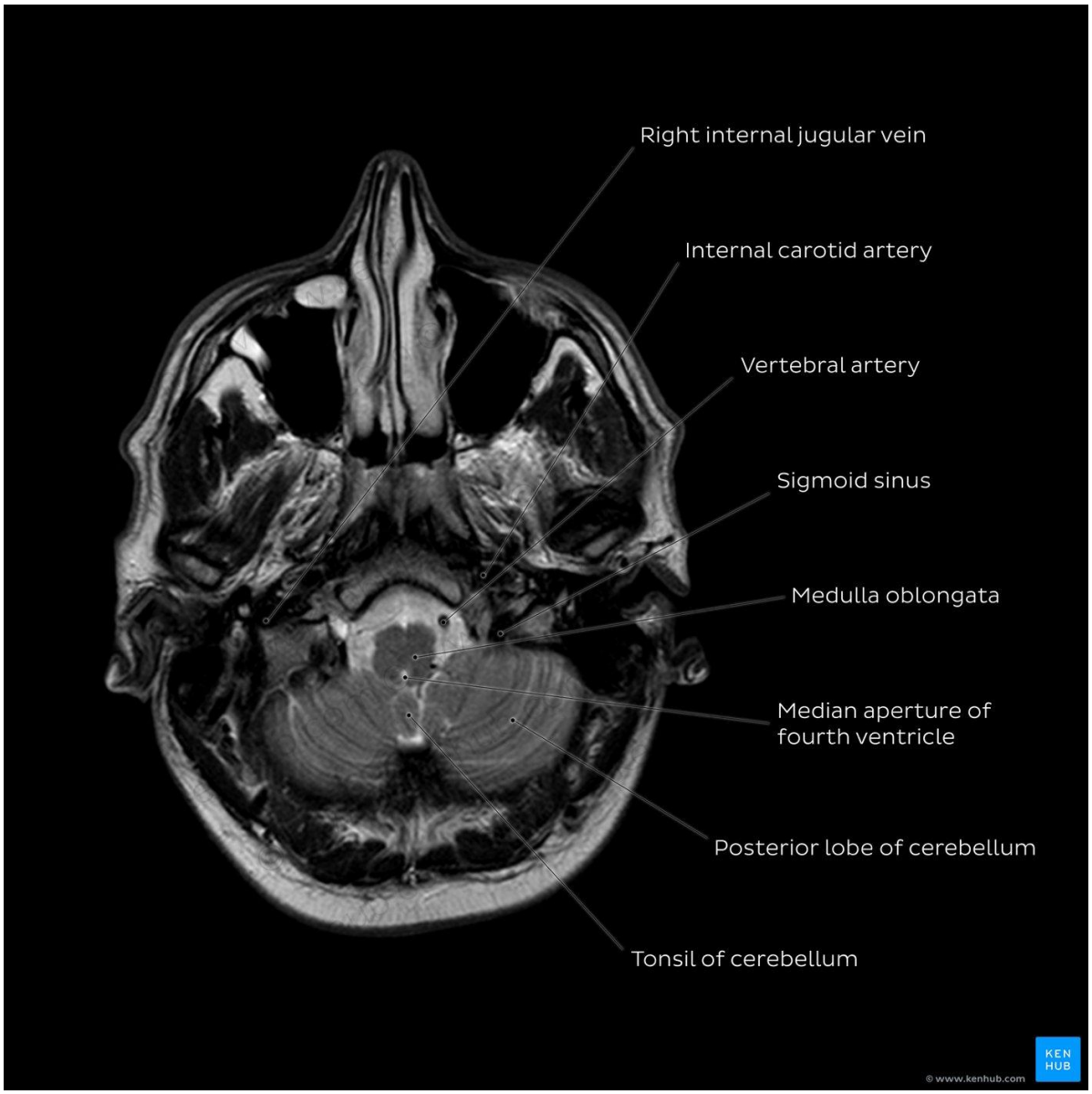
Pons



Modulla ablangata

Cerebellum:

The cerebellum lies below the occipital lobe of the brain, occupying the posterior cranial fossa. It consists of the right and left hemispheres that are interconnected by a midline area called the vermis. The cerebellum sits in the posterior cranial fossa via its two projections called the cerebellar tonsils.



Brain MRI (cerebellum level)