MRI and CT of the CNS

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Computed Tomography

CT is used for the detection of intracranial lesions. CT relies on the same physics as conventional x-rays, in that structures are distinguished from one another by their ability to absorb energy from x-rays. The x-ray tube emits a narrow beam of radiation as it passes in a series of scanning movements through an arc of 180 degrees around the patient's head. The x-rays having passed through the head are collected by a special x-ray detector. The information is fed to a computer that processes the information, which is then displayed as a reconstructed picture on a television like screen.

The observer sees an image of a thin slice through the head. The gray matter of the cerebral cortex, white matter, internal capsule, corpus callosum, ventricles, and subarachnoid spaces can all be recognized. An iodine-containing medium can be injected intravascularly, which enhances greatly the contrast between tissues having a different blood flow.

Since a CT scan can be performed in 5 to 10 minutes, it is the method of choice in an emergency situation with patients with head trauma or suspected intracranial hemorrhage.

Magnetic Resonance Imaging

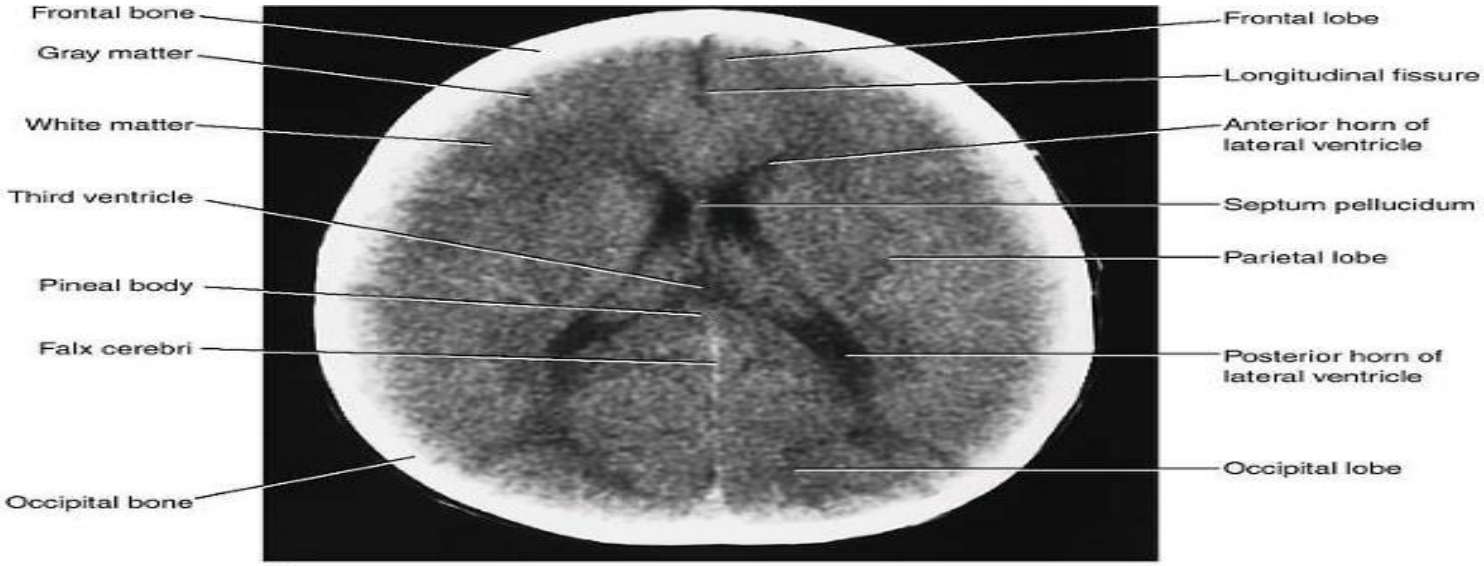
The technique of MRI uses the magnetic properties of the hydrogen nucleus excited by radiofrequency radiation transmitted by a coil surrounding the head. The excited hydrogen nuclei emit a signal that is detected as induced electric currents in a receiver coil. it provides better differentiation between gray and white matter.
The reason for this is that gray matter contains more hydrogen in the form of water than does white matter, and the hydrogen atoms are less bound in fat . MRI is the best imaging method for detecting low-contrast lesions h as brain tumors or small multiple sclerosis plaques. It is also capable of showing clear images of the brain stem, cerebellum, and the pituitary fossa, which in the case of a CT scan are overshadowed by the dense bones of the base of the skull. The spinal cord structure is much more clearly visualized with MRI.
Unfortunately, an MRI takes longer and costs two-thirds more than a CT scan

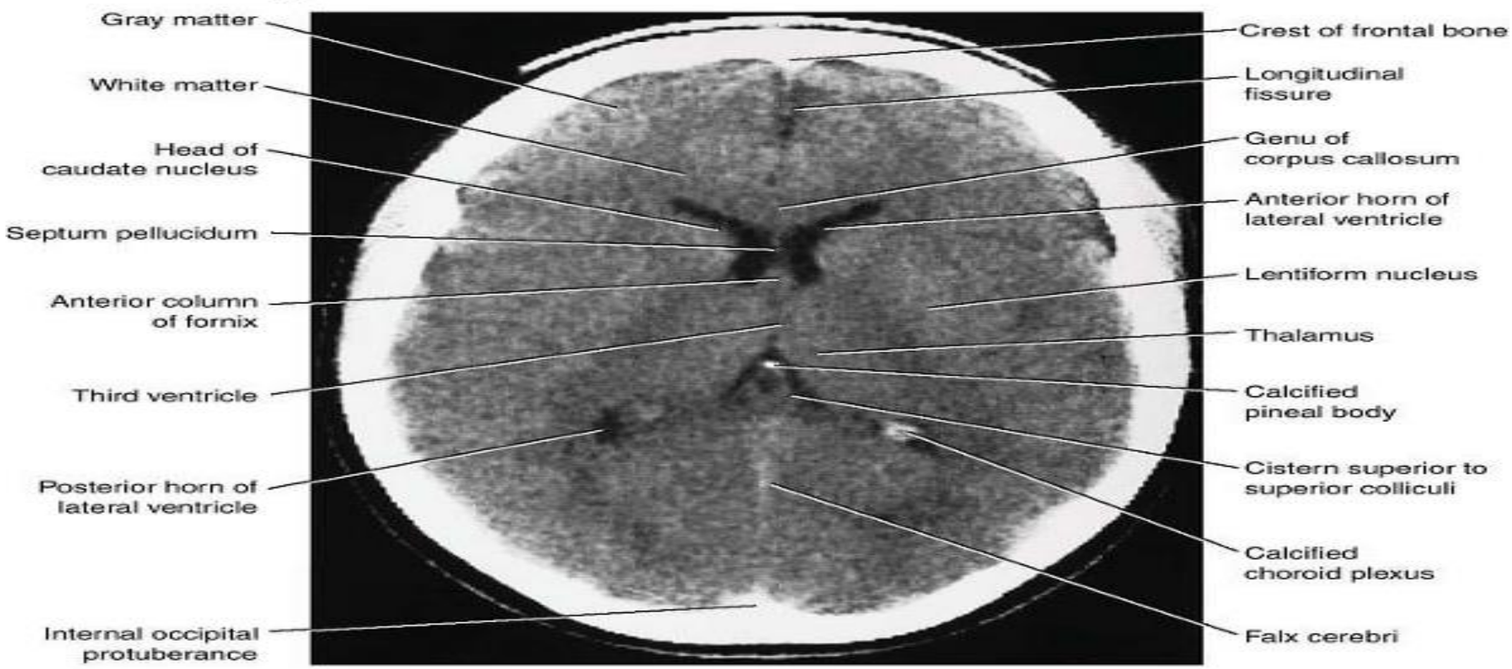
Positron Emission Tomography

Positron emission tomography (PET) uses radioactive isotopes that decay with the emission of positively charged electrons (positrons) to map the biochemical, physiologic, and pharmacologic processes taking place in the brain.The appropriate isotope is incorporated into molecules of known biochemical behavior in the brain and then is injected into the patient.

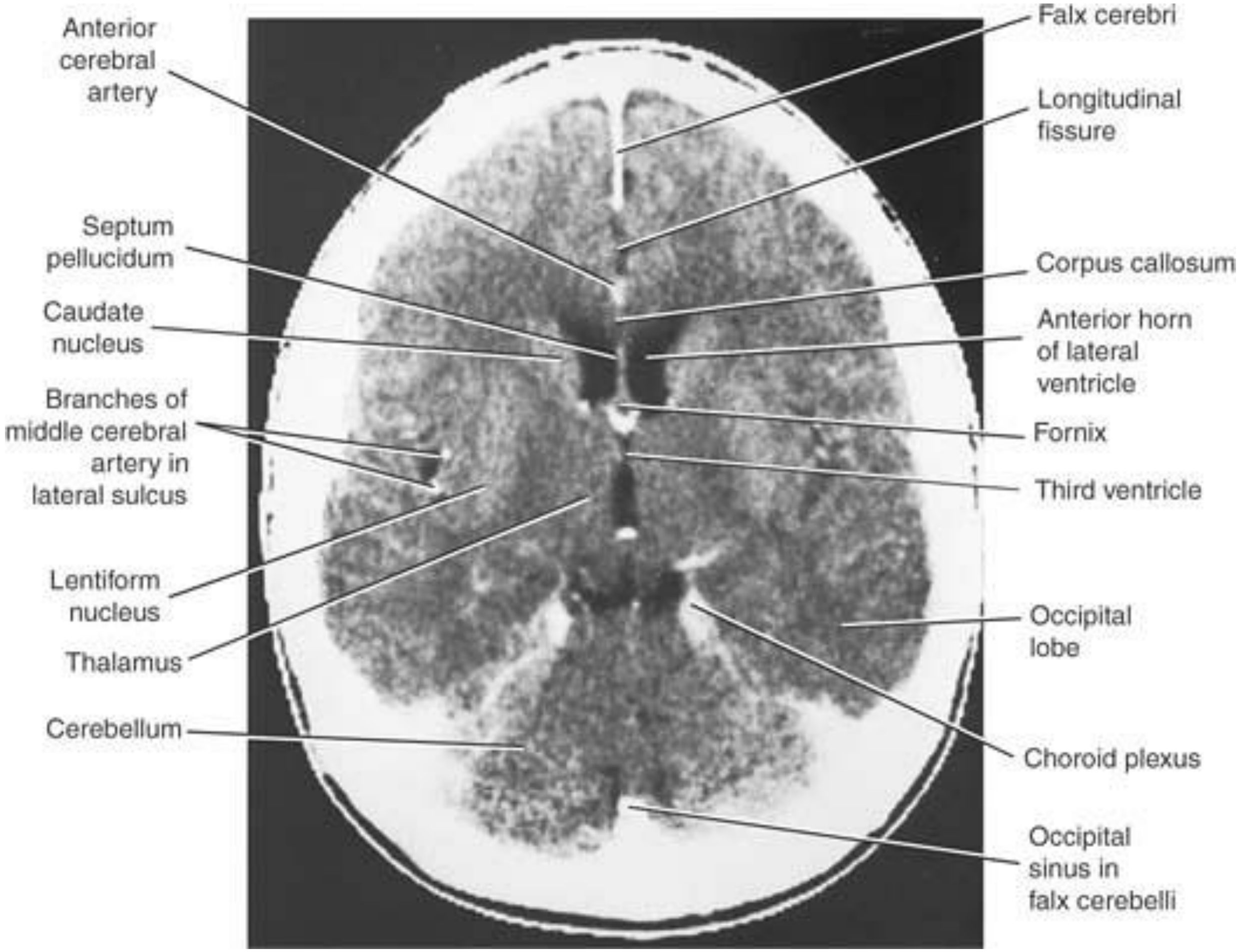
The metabolic activity of the compound can then be studied by making cross-sectional tomographic images of the brain using the same principles as in CT. By making a series of time-lapse images at different anatomical sites, it is possible to study the variations in brain metabolism at these sites. This technique has been used to study the distribution and activity of neurotransmitters, the variations in oxygen utilization, and cerebral blood flow.

CT scan showing the structure of the brain. A, B: Horizontal cuts (axial sections)

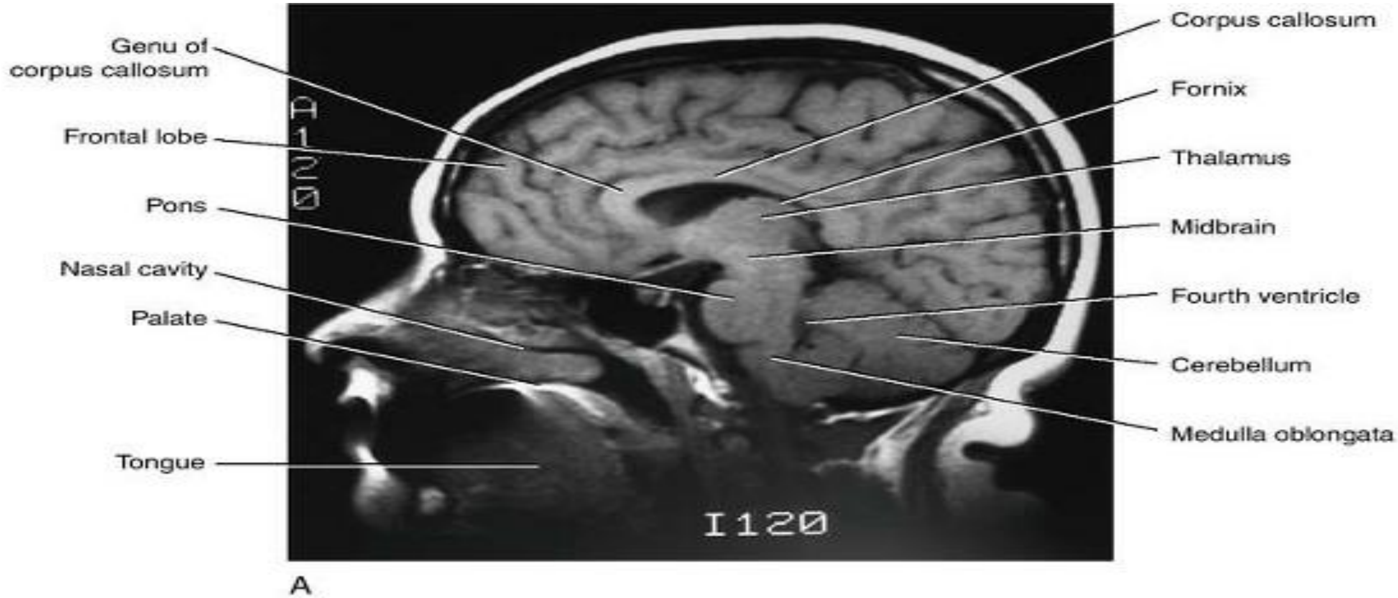




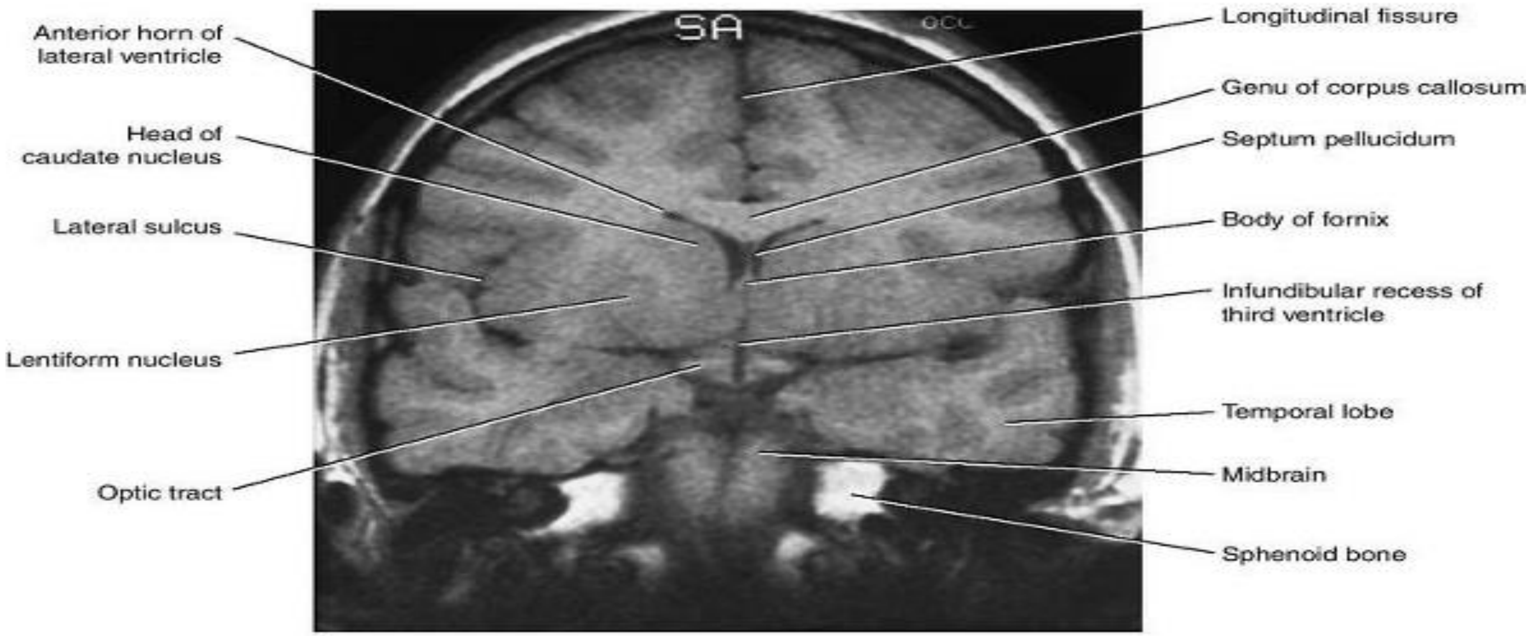
Horizontal (axial) CT scan of the brain (contrast enhanced).



MRI showing the structure of the brain. A: Sagittal. B: Coronal.

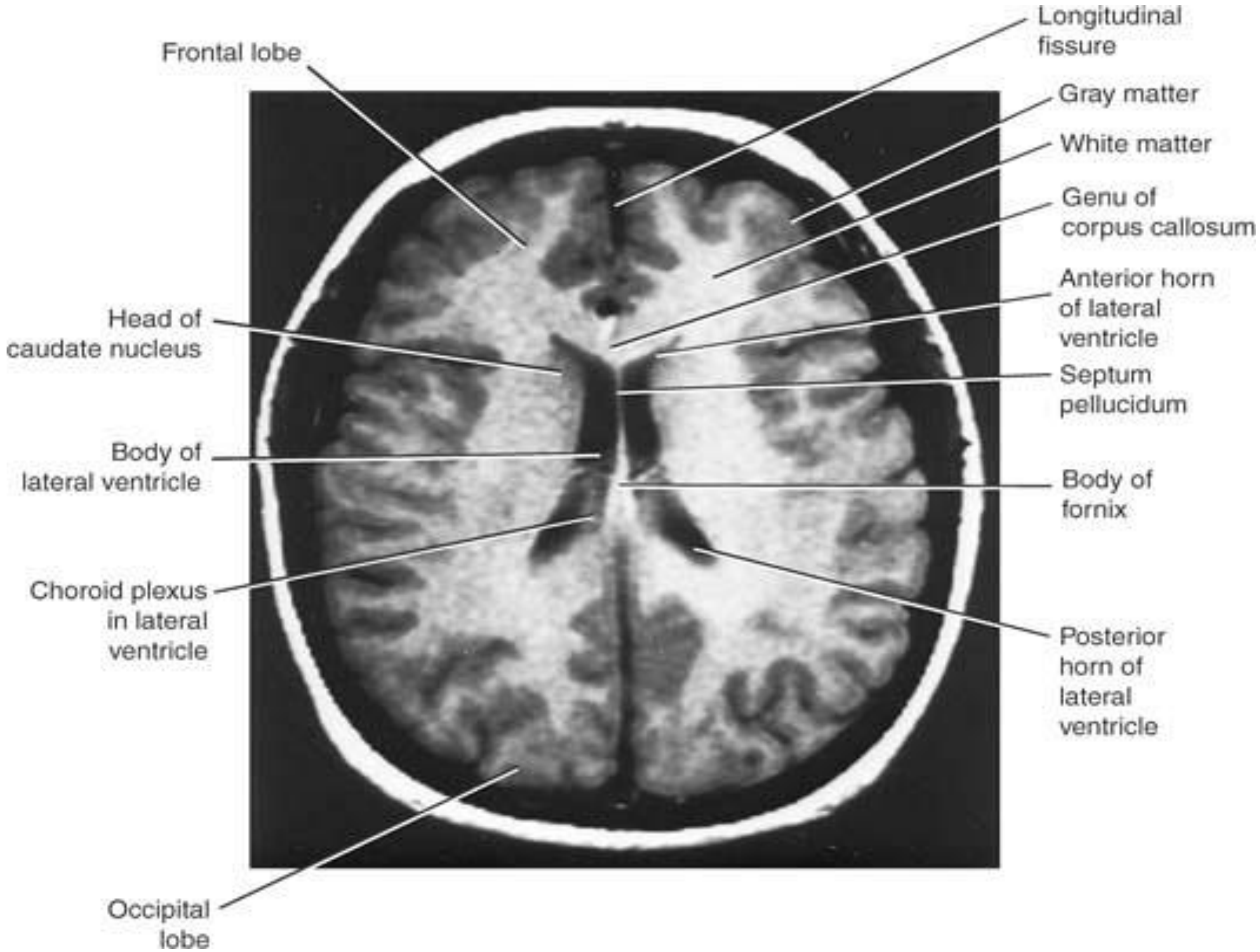


A

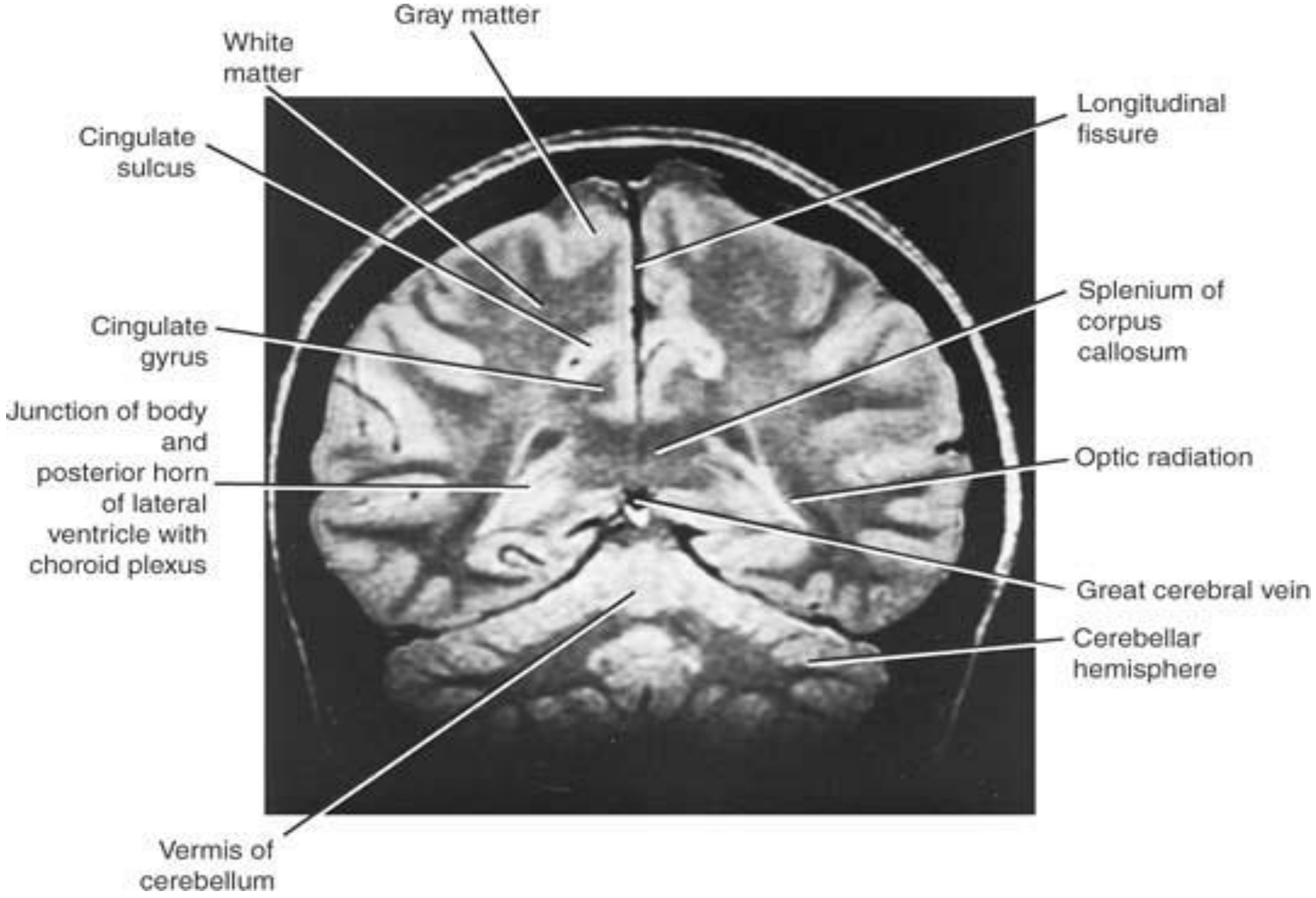


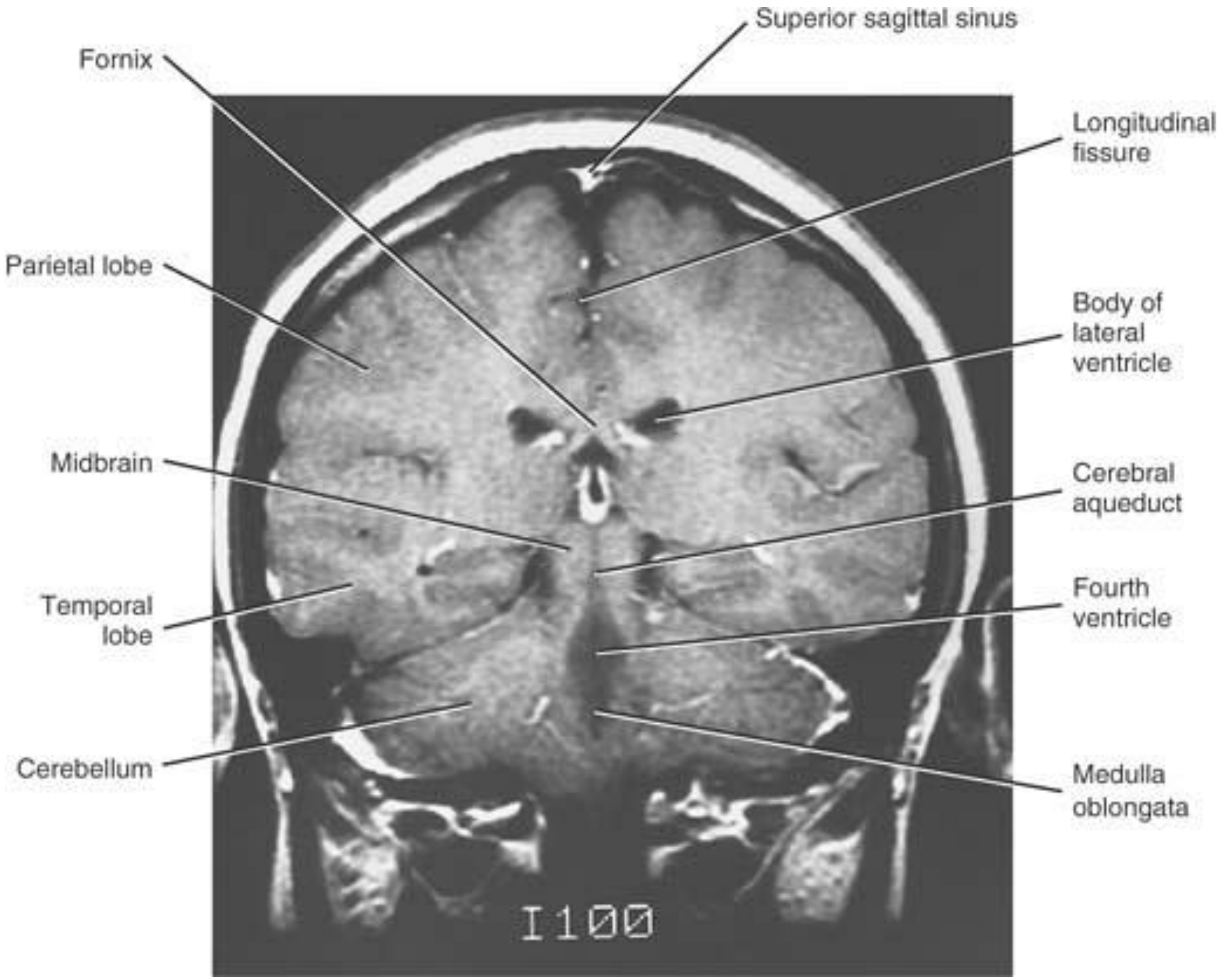
B

Horizontal (axial) MRI of the brain.

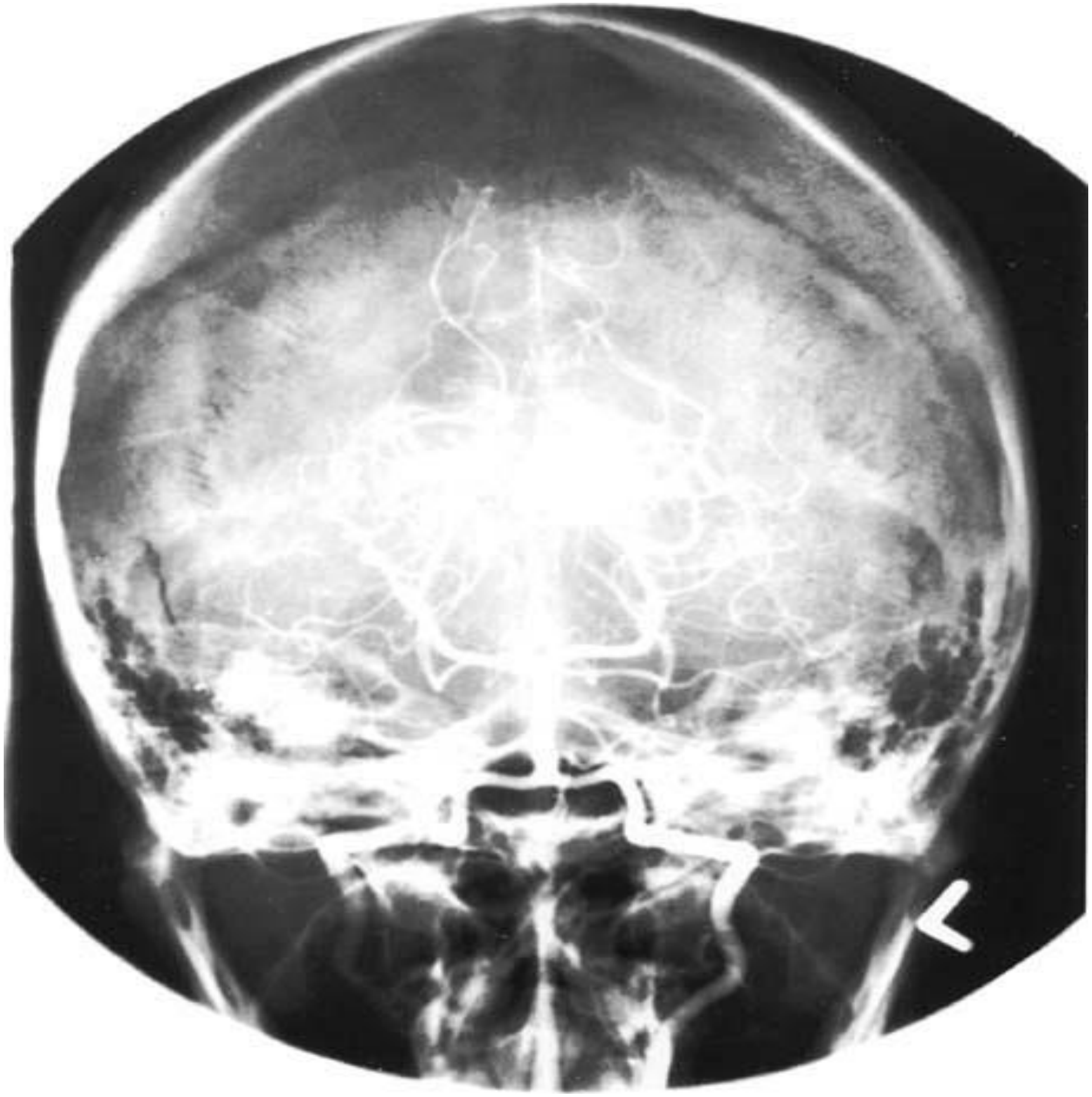


Coronal MRI of the brain.

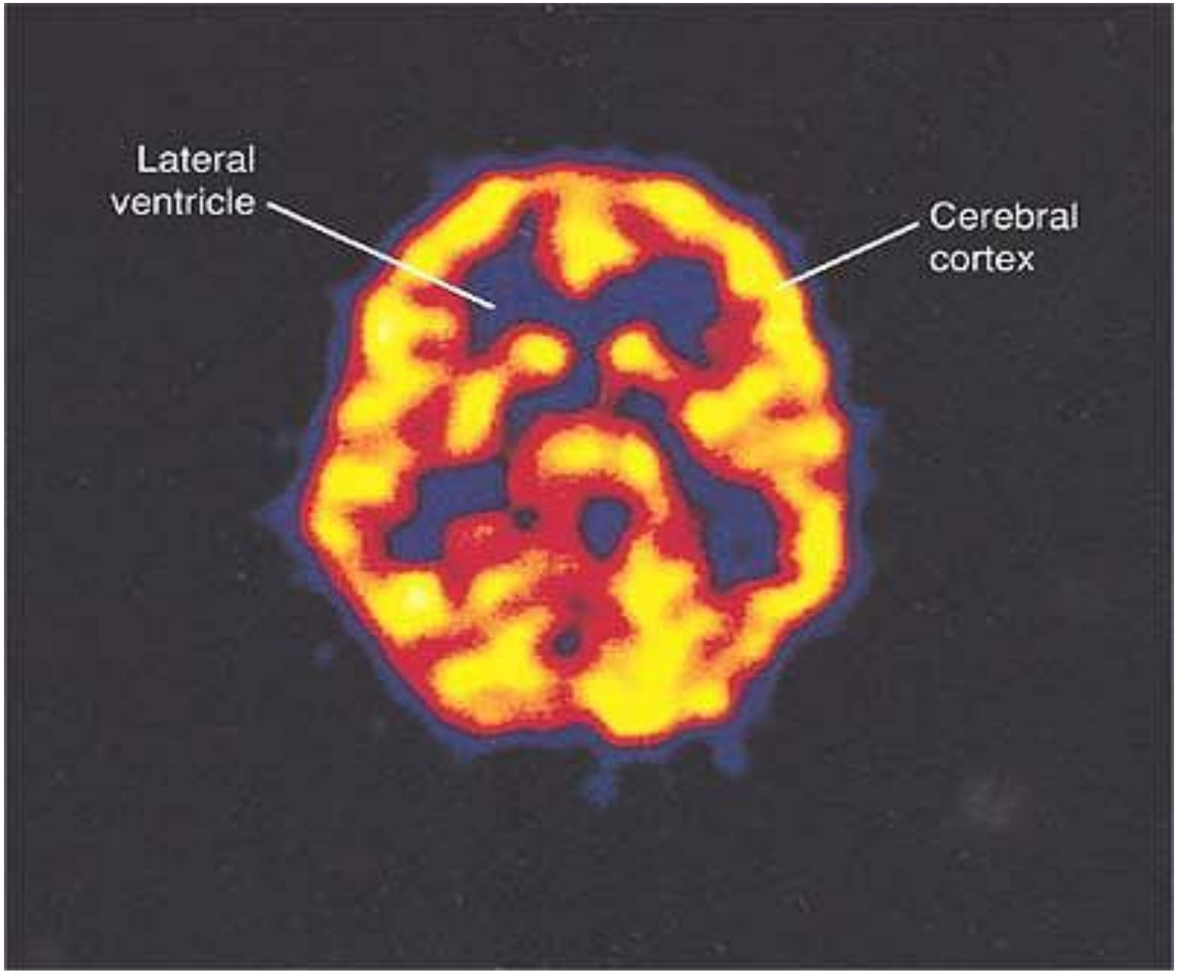




A coronal MRI (contrast enhanced) through the hindbrain showing the fourth ventricle and the surrounding neural and bony structures.

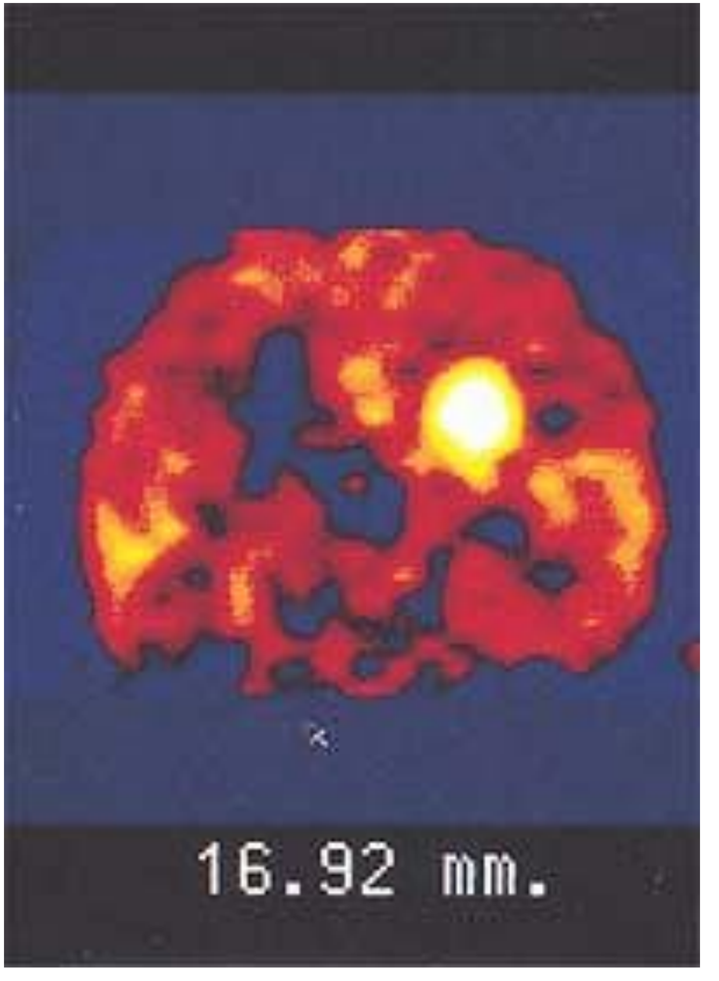


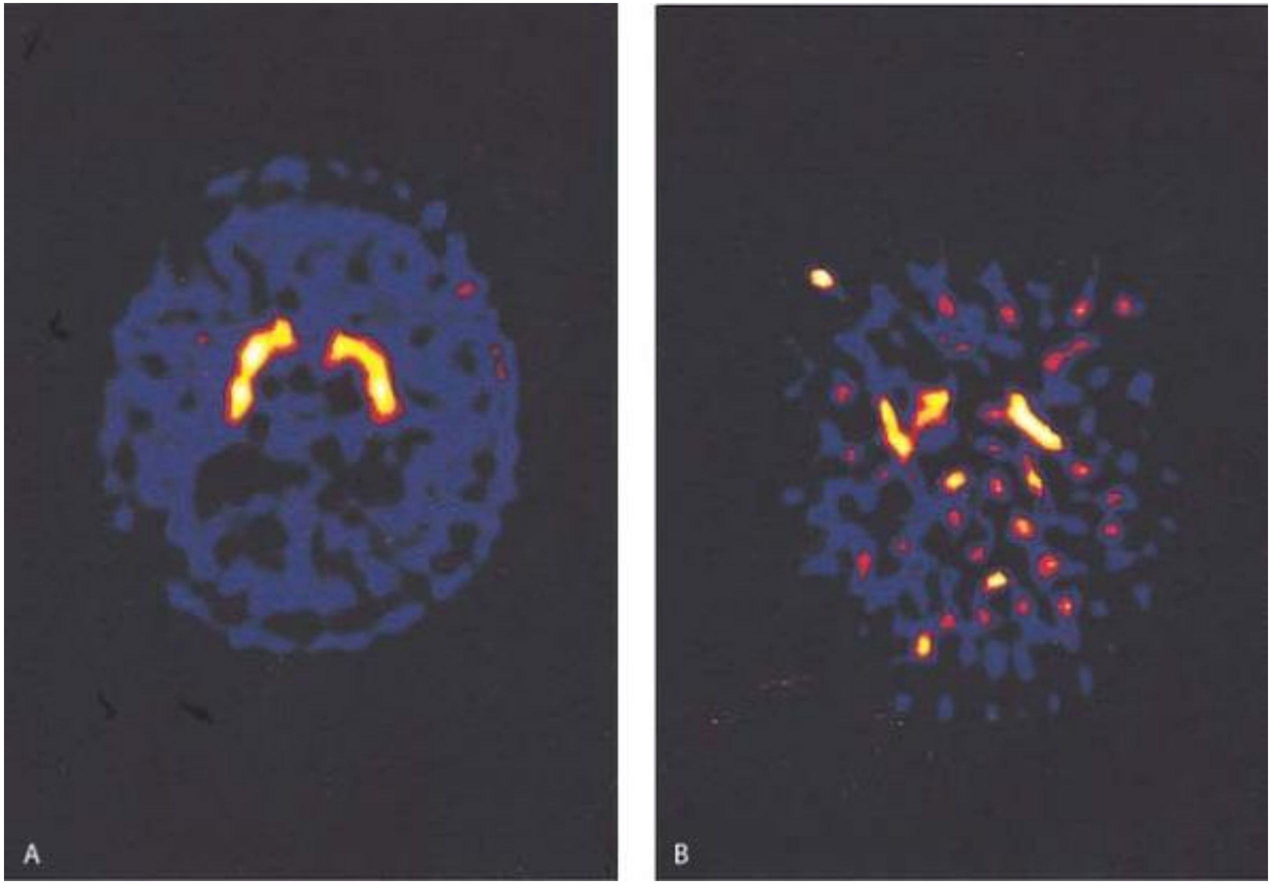
Anteroposterior (angled) vertebral arteriogram. Woman aged 35 years.



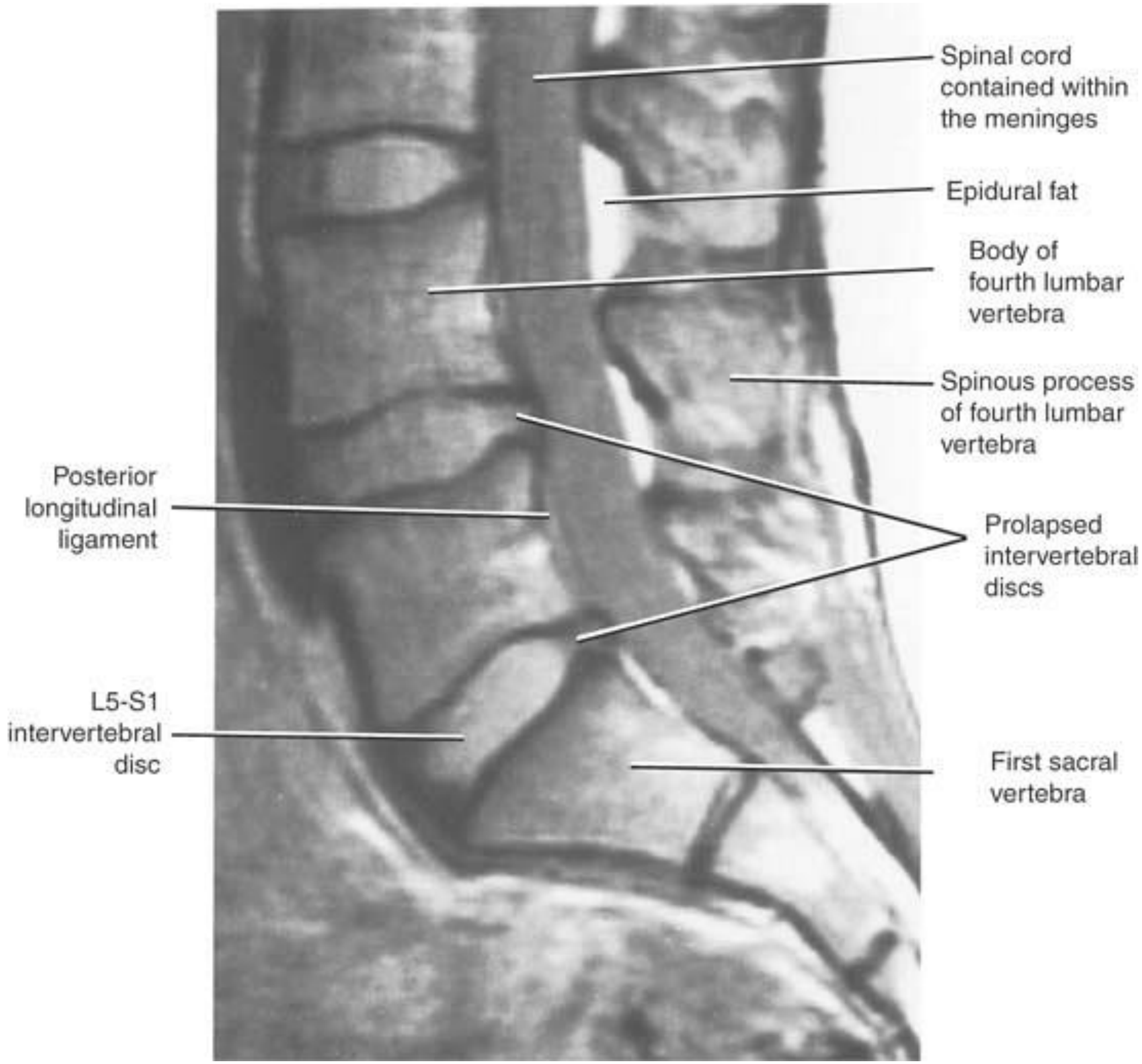
Axial (horizontal) PET scan of a normal brain following the injection of 18-fluorodeoxyglucose. Regions of active metabolism (yellow areas) are seen in the cerebral cortex. The lateral ventricles are also demonstrated. (Courtesy Dr. Holley Dey.)

Coronal PET scan of a 62-year-old male patient with a
malignant glioma in the left parietal lobe, following the injection of 18-fluorodeoxyglucose (same patient as in Fig. 1-26). A high concentration of
the compound (circular yellow area) is seen in the region of the tumor.

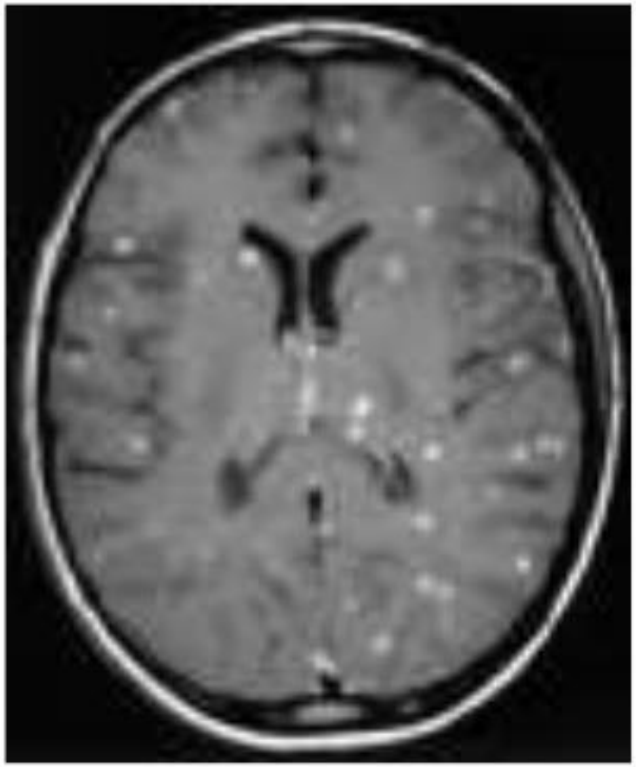




Axial (horizontal) positron emission tomography (PET) scans of a normal brain (**A) and** the brain of a patient with early Parkinson disease (**B) following the injection of 18- fluoro-6-Ldopa.** The normal brain image shows large amounts of the compound (yellow areas) distributed throughout the corpus striatum in both cerebral hemispheres. In the patient with Parkinson disease, the brain image shows that the total amount of the compound is low, and it is unevenly distributed in the corpus striatum. (Courtesy Dr. Holley Dey.)

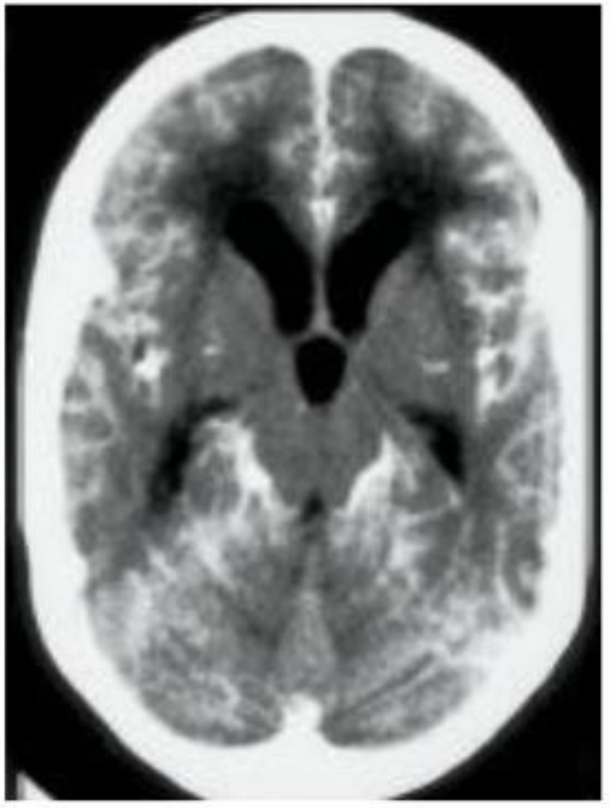


Sagittal MRI of the lumbosacral part of the vertebral column showing several prolapsed intervertebral discs.



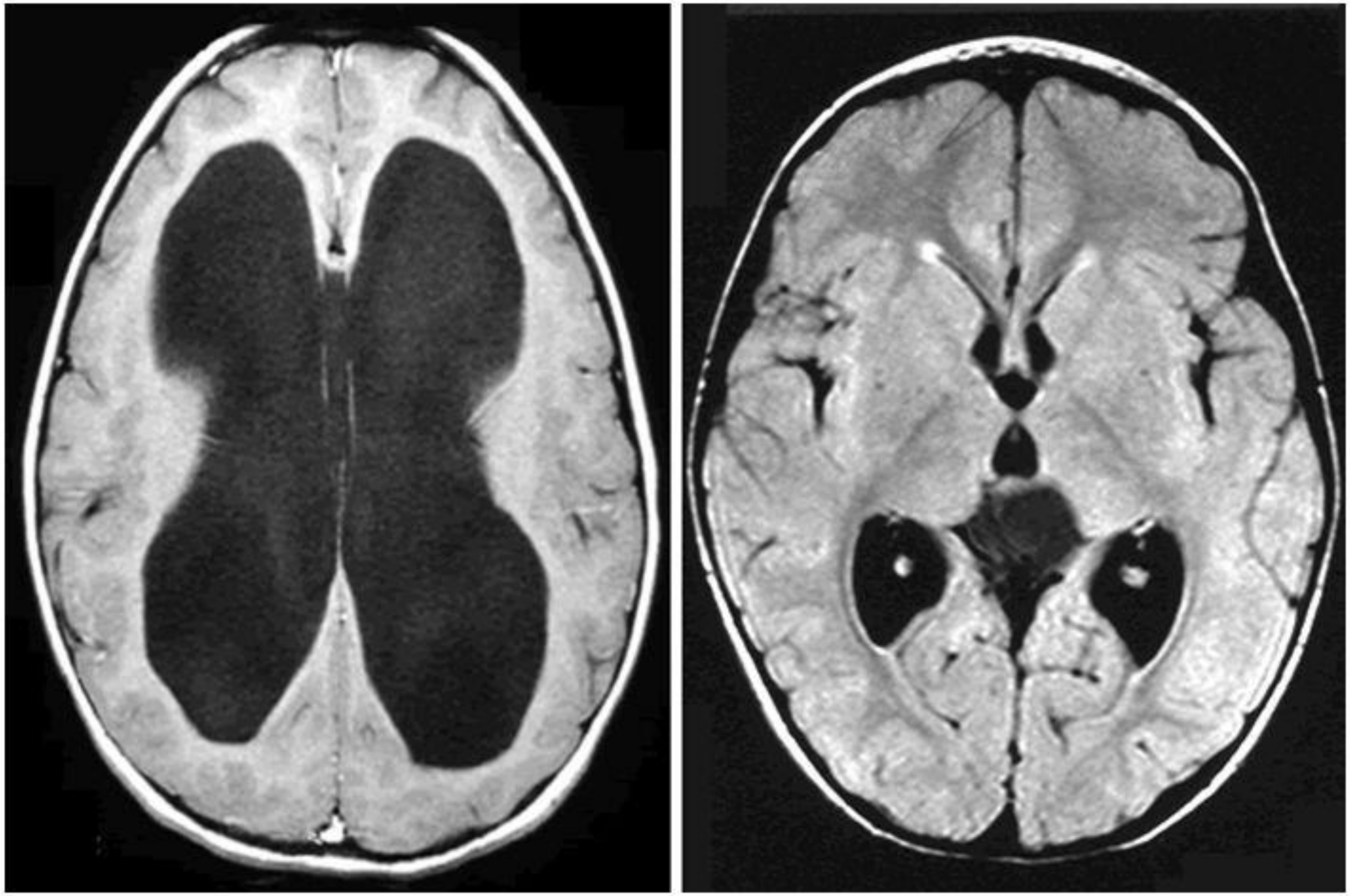
Miliary CNS tuberculosis

Axial **Contrast-enhanced T1-weighted MR image** shows multiple small high-signal-intensity foci within both cerebral hemispheres



CT+C of a child with tuberculous meningitis demonstrating acute hydrocephalus and meningeal enhancement

Hydrocephalus vs Normal – MRI view



An MRI scan of a brain with hydrocephalus (left) and a normal MRI scan (right). The large dark area on the left is the ventricles, made bigger by a build-up of CSF

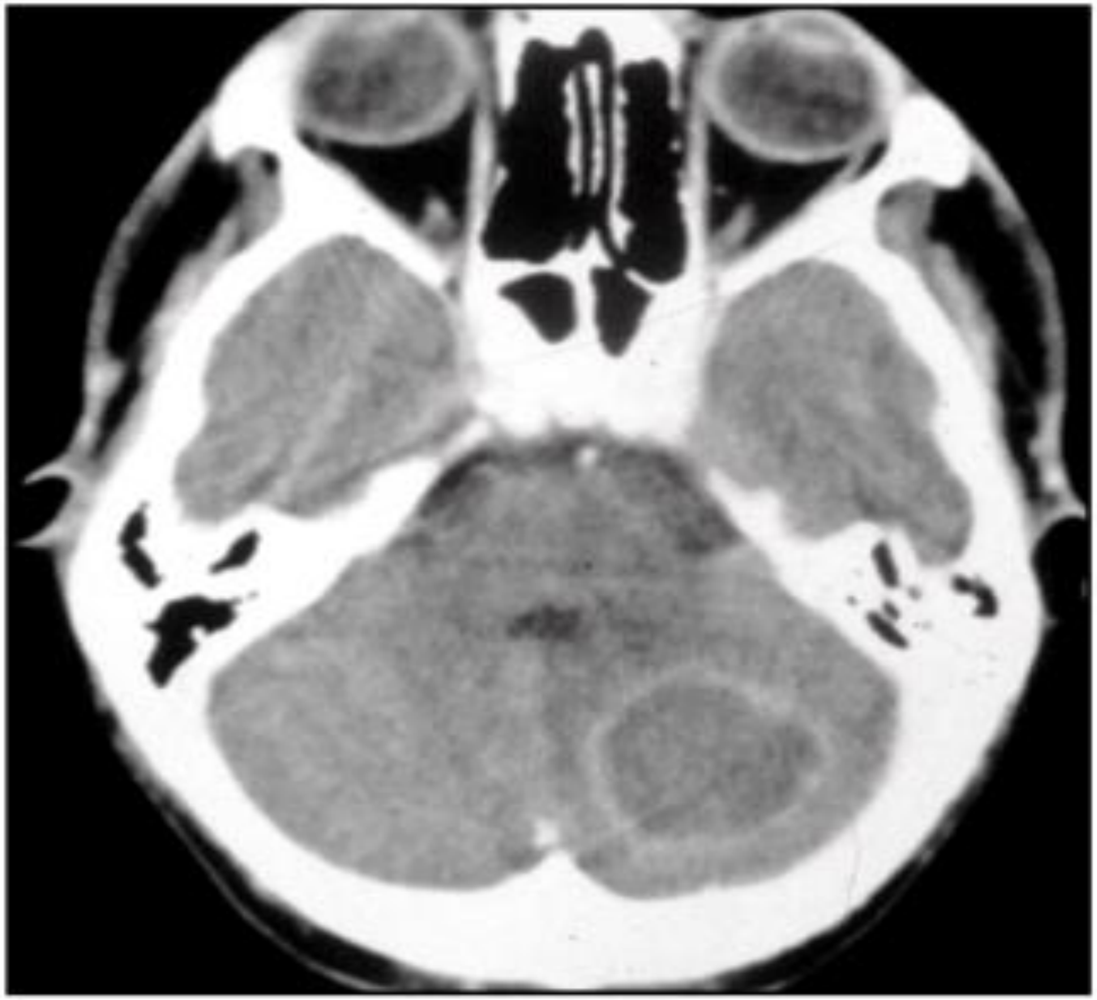
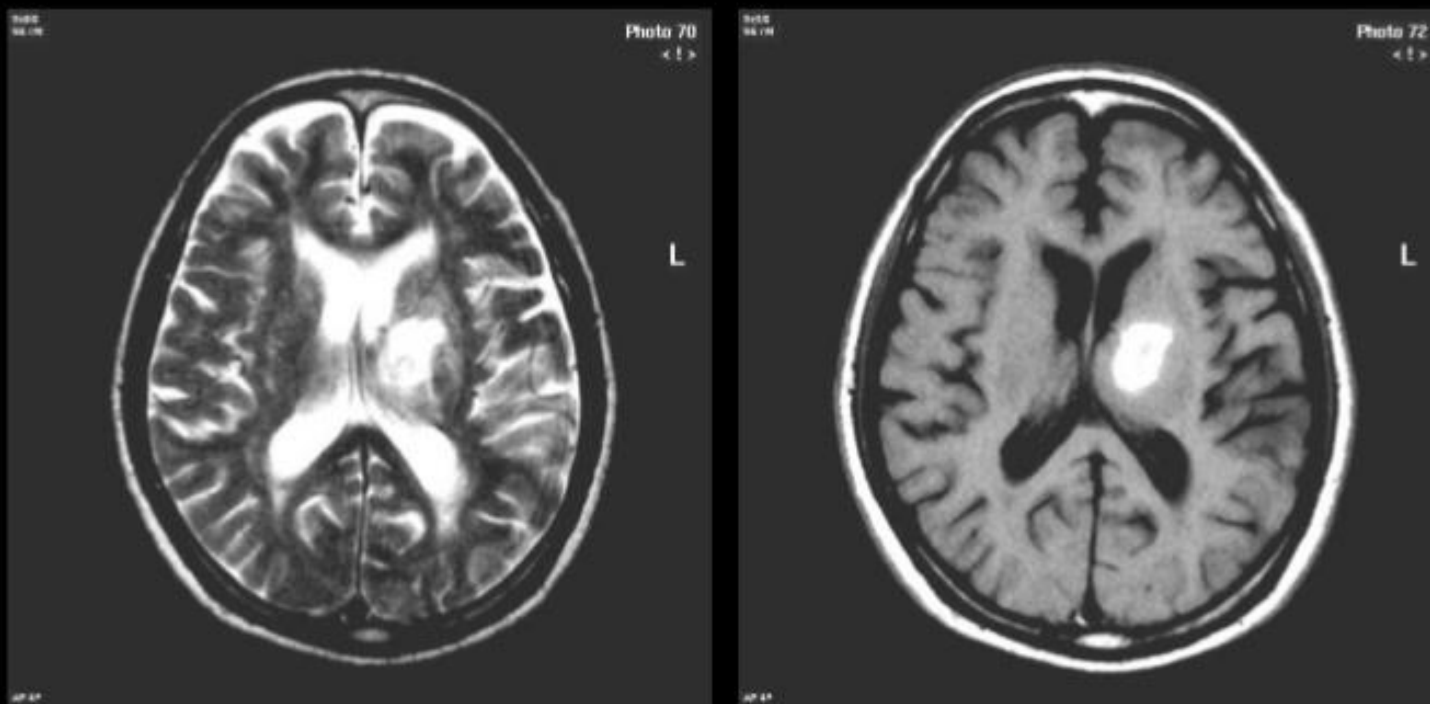


Fig 1. Contrast-enhanced computed tomography scan of case 1, showing a large unique ring-enhancing lesion in the left cerebellum, sourrounded by discrete edema.

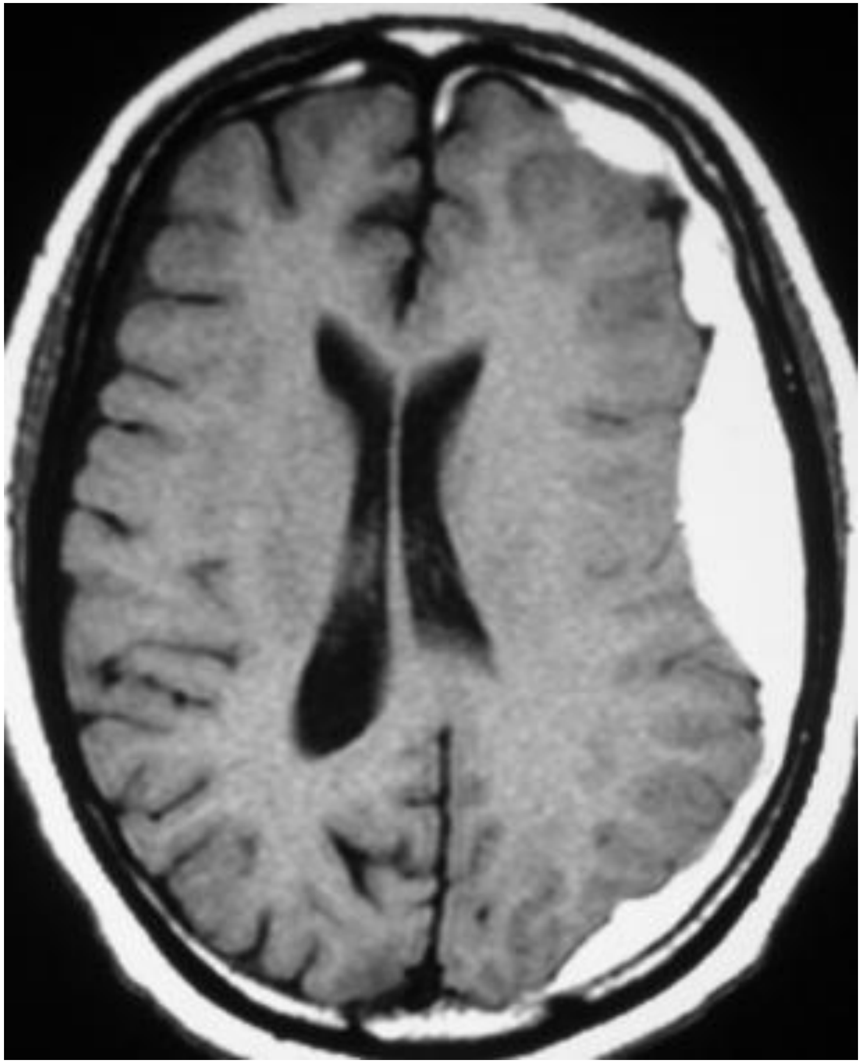
Cerebral Abscess – MRI scan

This MRI scan of the head in transverse (axial) view demonstrates a small abscess in the brain (Red arrow) in a patient who had septicemia

Chronic intracranial hemorrhage



MRI showing fronto temporal Subdural haemorrage



THANK YOU