Slide 1

Computed Tomography (CT):

A "simplified" Topographical review of the Brain

Jon Wheiler, ACNP-BC

Slide 2

Tomography vs Topography

Tomography:

- A technique for displaying a representation of a cross section through a human body or other solid object using X-rays or ultrasound:

Topography:

- A detailed description or representation on a map of the natural and artificial features of an area:

Slide 3

Learning Objective

To reinforce and expand your knowledge base regarding computed tomography and brain anatomy whereby enhancing your function as a Healthcare provider.

Slide 4

Disclosure:

I am not a Radiologist, Neuroradiologist, Neurologist, Neurointensivist, or Neurosurgeon:

I have no financial affiliation with any commercial supporters of this conference:

Slide 5

Outline

- Computed Tomography Design and Function
- Neuroanatomy
- Head CT Mapping

Slide 6

Computed Tomography Basics

Slide 7

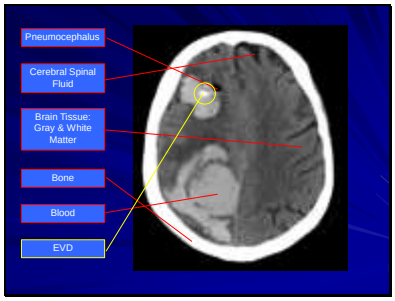
Computed Tomography (CT) Physics

Physics of CT simplified:

- CT is comprised of a rotating Xray source and detector
- The X-rays are absorbed in varying degrees by different tissues
- A computer assigns numerical numbers based on tissue density
- Hounsfield Units (HUs) : Sir Godfrey Newbold Hounsfield
  - HU Table:
    - Air -1000
    - Water 0
    - Bone +1000
- Anatomy
- Windowing:
  - Center – HU value
  - Width - +/-
  - Numerical Values based on density

Substance	HUs
Air	-1000
Fat	-120
Water	0
Muscle	+40
Bone	+400

Slide 8



Slide 9

Computed Tomography Scan

The images generated are generally in the axial or transverse plane, modern scanners allow this volume of data to be reformatted in various planes or even as volumetric (3D) representations of structures.

- Axial
- Sagittal
- Coronal

Slide 10

Computed Tomography Brain: Uses

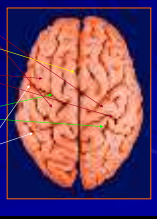
Uses:

- Blood (Intracranial hemorrhage, Trauma, Cerebral Edema)
- Ischemia (Stroke, Trauma, Encephalopathy)
- Enlarged Ventricles (Hydrocephalus, Trauma, ICH)
- Foreign Objects (Trauma, GSW, Diseases)
- Brain Mass/Lesion
- Diseases or malformations of the cerebral vasculature, brain tissue, and/or skull

Slide 11

Brain Terminology

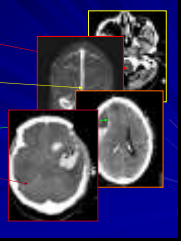
- **Gyrus** - a convoluted ridge between anatomical grooves
- **Cerebri**:- two folds of Dura mater separating the hemispheres of the brain (falx cerebri)
- **Cerebral Cortex**: brain matter differentiated into gray and white matter characteristically connected by different layers and neuronal types
- **Sulcus** - a shallow furrow on the surface of the brain separating adjacent convolutions
- **Fissure** - any of the deep clefts of the brain ; (Lateral [Sylvian] fissure)



Slide 12

Brain Terminology

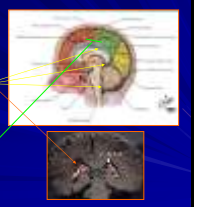
- **Cistern** – widened subarachnoid spaces/reservoir for storing CSF: usually found at the base of the brain
- **Sinuses** – a dilated channels found between layers of Dura mater in the brain for venous blood flow.
- **Meninges**: Dura – Arachnoid – Pia matter. The system of membranes which envelops the central nervous system. The dura being the outermost, thickest layer.
- **Falx cerebelli** - an arched fold of dura mater forming a partition between the cerebrum and cerebellum:



Slide 13

Brain Terminology

- **Choroid Plexus** - is the area on the ventricles of the brain where cerebrospinal fluid is produced by modified ependymal cells.
- **Ventricular System** - A system of communicating cavities in the brain that are continuous with the central canal of the spinal cord providing a pathway for CSF
- **Ganglia**: the "basal ganglia" is a group of nuclei interconnected with the cerebral cortex, thalamus and brainstem



Slide 14

Brain Terminology

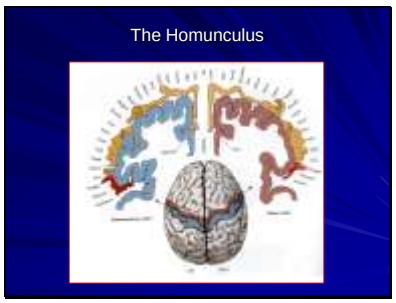
- Insula –(Insular Cortex) considered the 5th lobe of the cortex which separates the temporal lobe the parietal lobe dorsally.
- Hemisphere – left and right: Dominant vs Nondominant
- **Lobes** – purely anatomical classification of areas of the brain related to different brain functions. Frontal lobe, Parietal lobe, Temporal lobe, Occipital lobe, Insula, and Cerebellum.
- **Regions** – Functional and cognitive areas of the brain as related to function: Sensorimotor Area, Hindbrain, Midbrain, Forebrain, & Neural pathways.

Slide 15

Anatomical Terminology

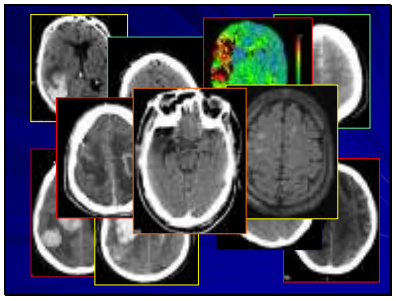
- Posterior – Toward the back – situated behind; dorsal.
- Anterior – Before or in front of – the abdominal side of the body.
- Dorsal – going from the belly to the spinal column.
- Ventral – going from the spinal column to the belly.
- Caudal – Inferior in position – towards the tail.
- Cephalad – Superior in position –towards the head/top.
- Inferior – Beneath – below – the undersurface.
- Superior – Higher than – Situated above.
- Medial – Pertaining to the middle – Nearer the medial plane.
- Lateral – Pertaining to the side – away from the mid-plane.
- Proximal/Distal - from tip of an appendage (distal) to where it joins the body (proximal).

Slide 16

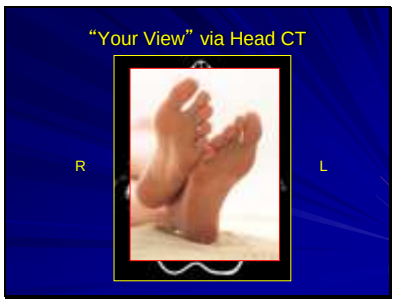


Slide 17

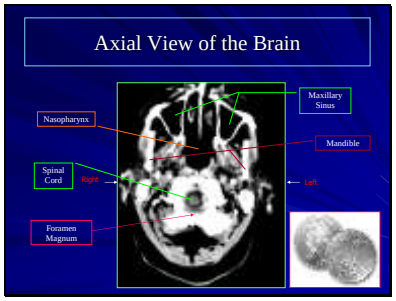
Slide 18



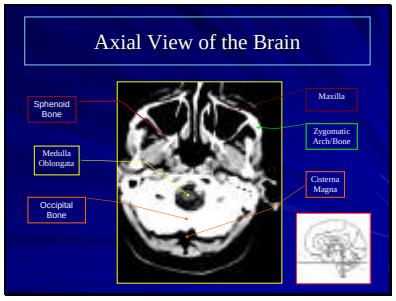
Slide 19



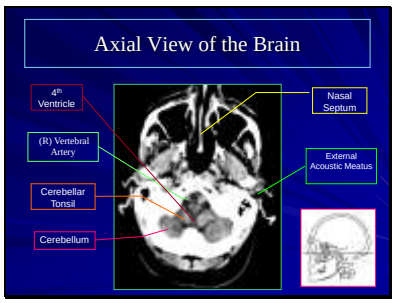
Slide 20



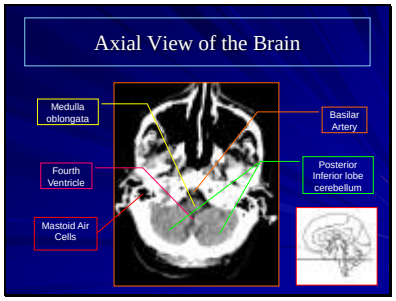
Slide 21



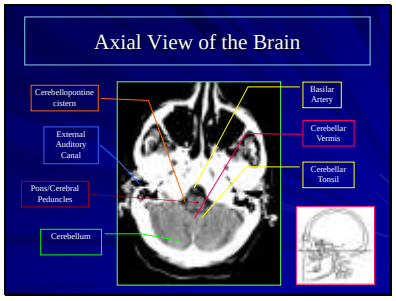
Slide 22



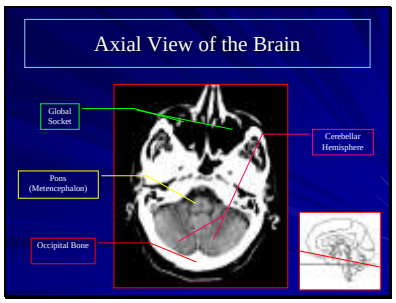
Slide 23



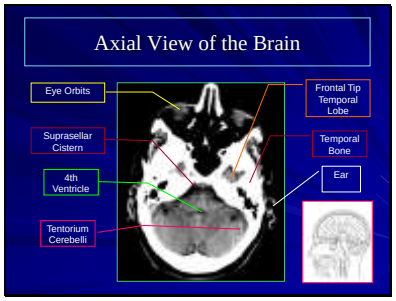
Slide 24



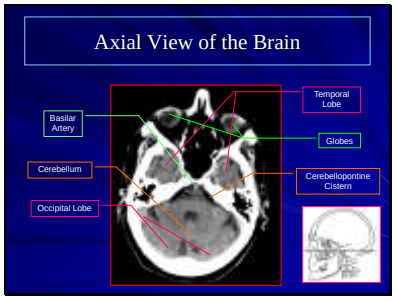
Slide 25



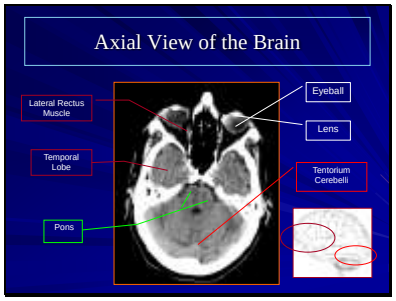
Slide 26



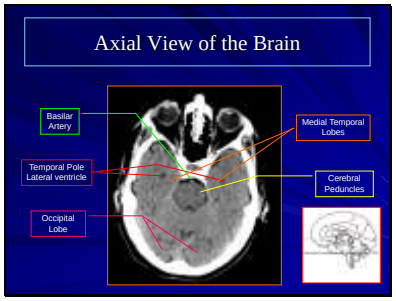
Slide 27



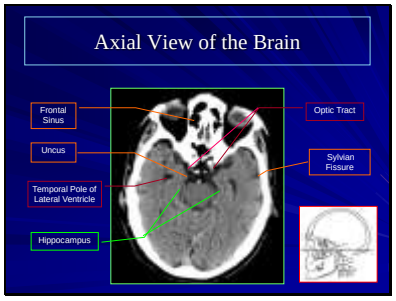
Slide 28



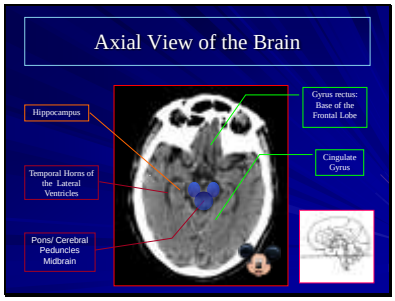
Slide 29



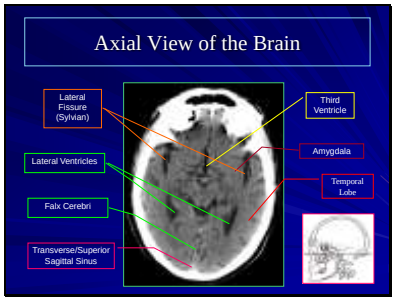
Slide 30



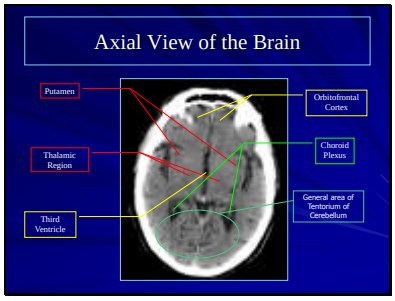
Slide 31



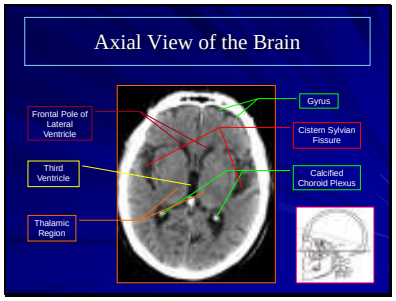
Slide 32



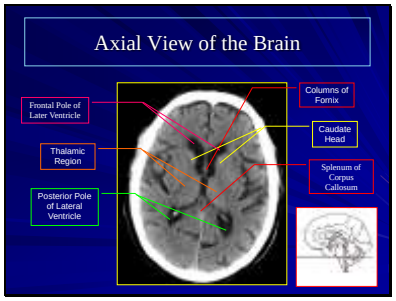
Slide 33



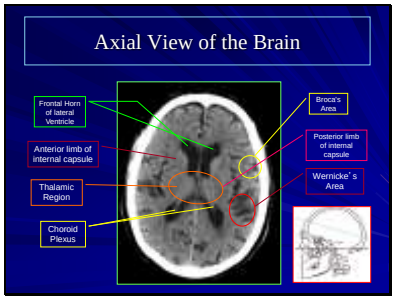
Slide 34



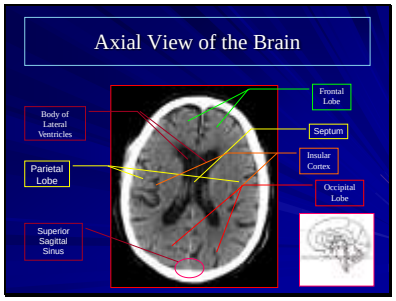
Slide 35



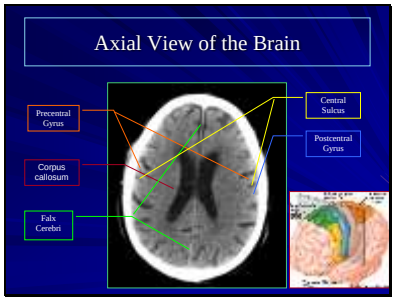
Slide 36



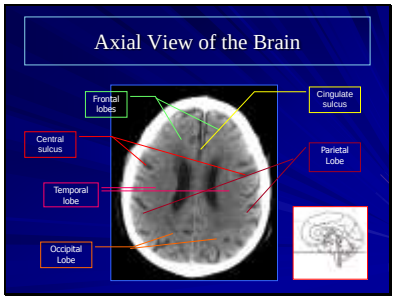
Slide 37



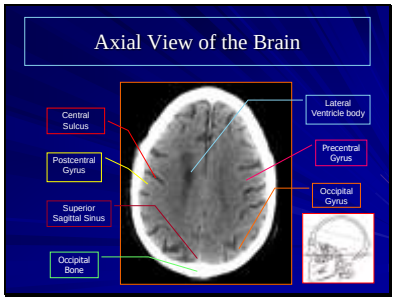
Slide 38



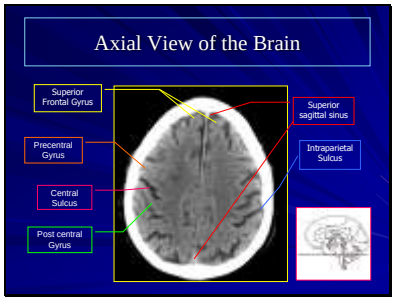
Slide 39



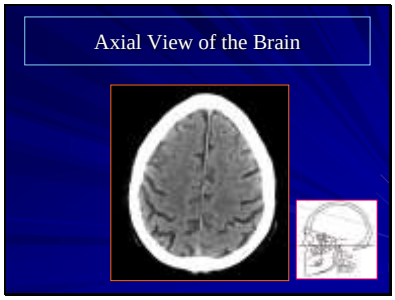
Slide 40



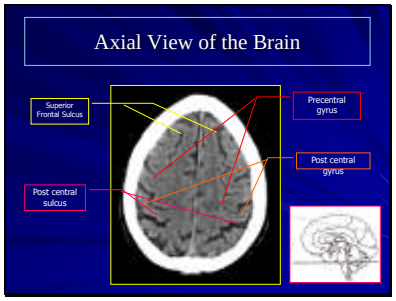
Slide 41



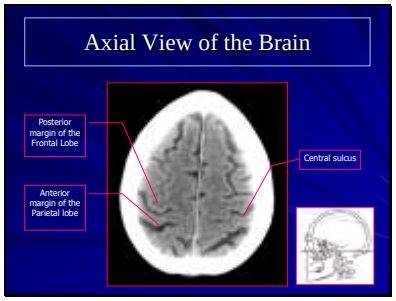
Slide 42



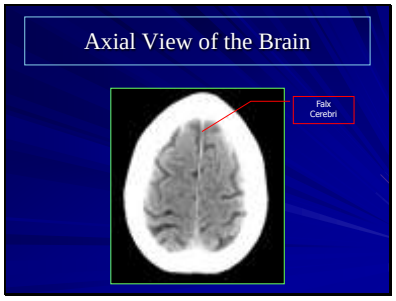
Slide 43



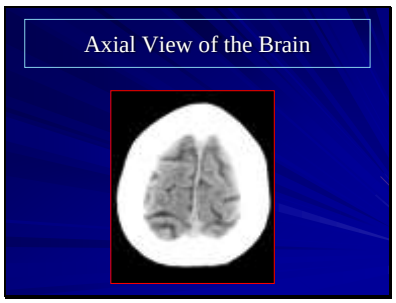
Slide 44



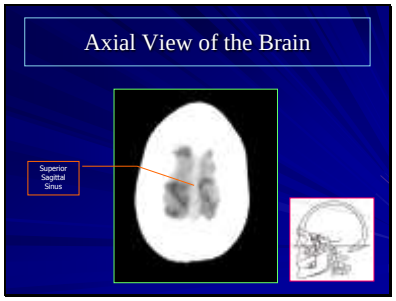
Slide 45



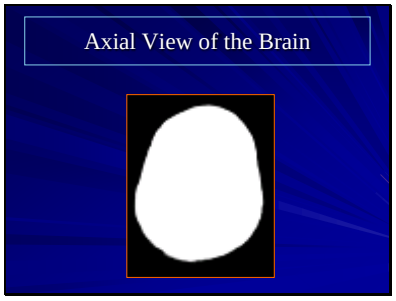
Slide 46



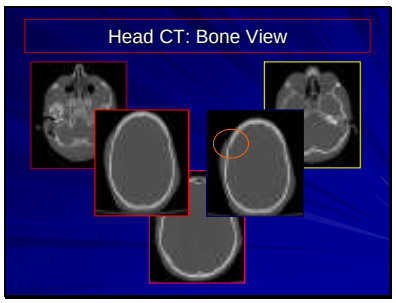
Slide 47



Slide 48



Slide 49



Slide 50