

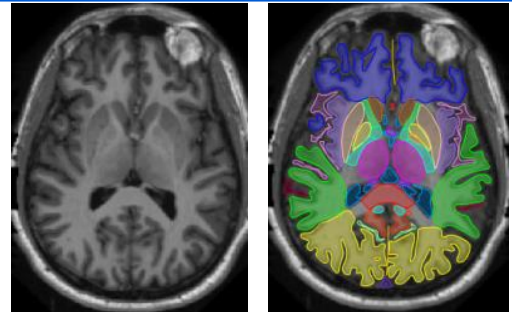
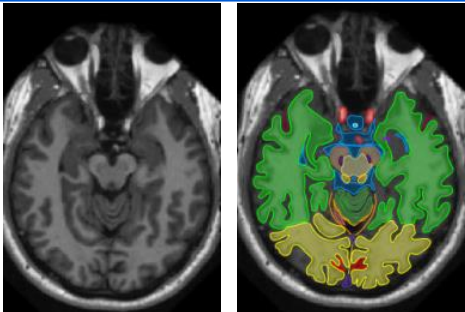
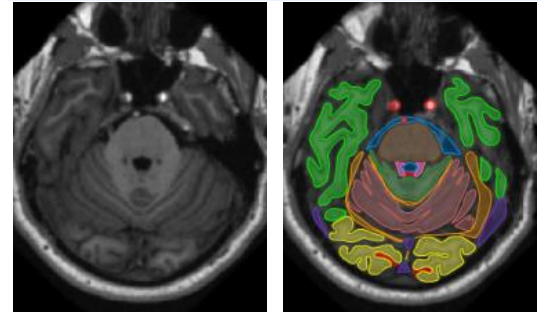
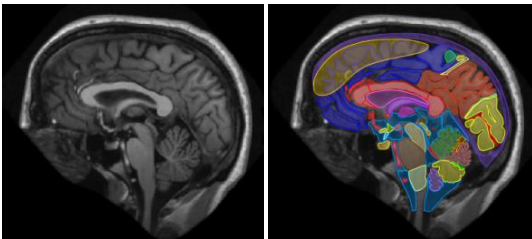


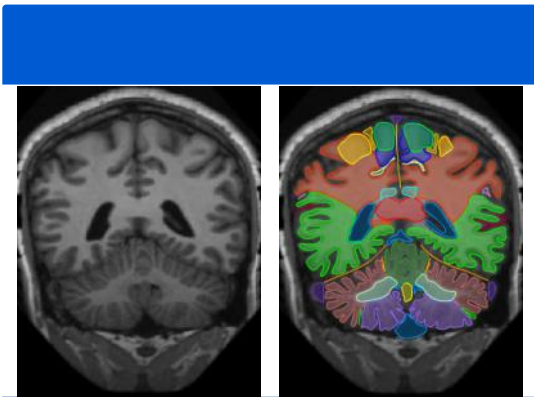
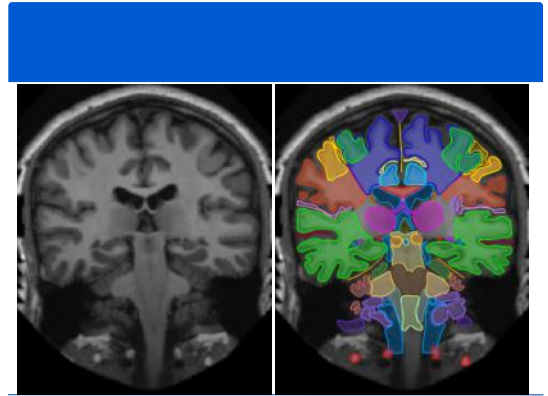
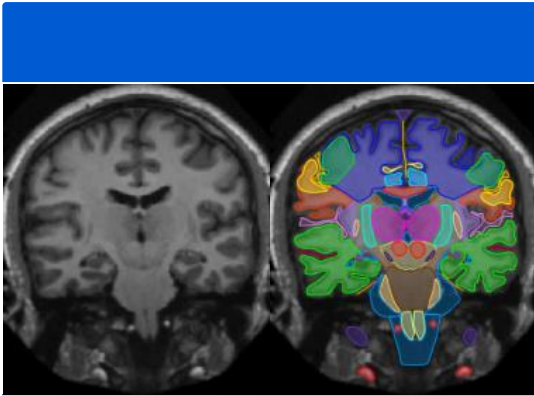
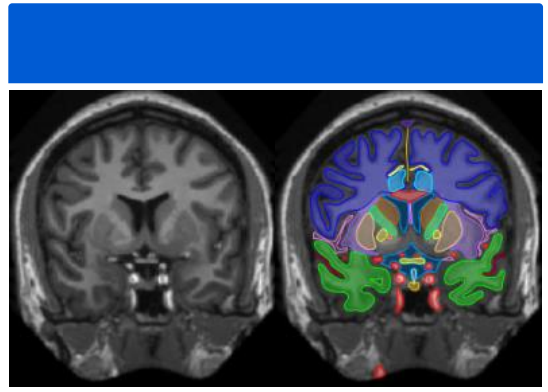
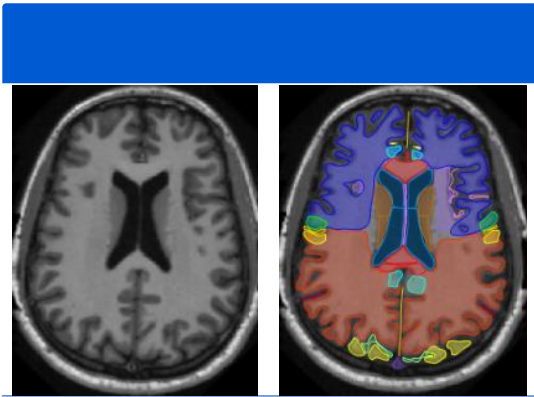
INTRODUCTION TO NEURORADIOLOGY (Brain & Spine)

Nail Bulakbaşı, M.D.
Professor of Radiology
Near East University Faculty of Medicine
Department of Radiology

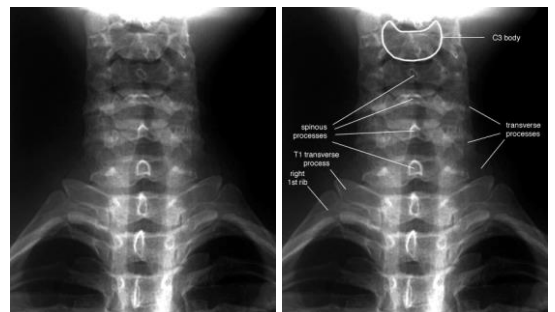
Learning Objectives

- Basic neuro-anatomy
- Imaging modalities



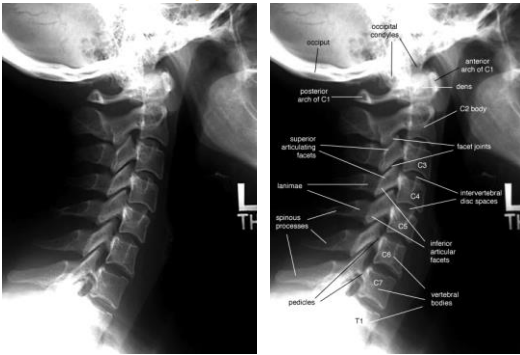


Cervical Spine – AP View



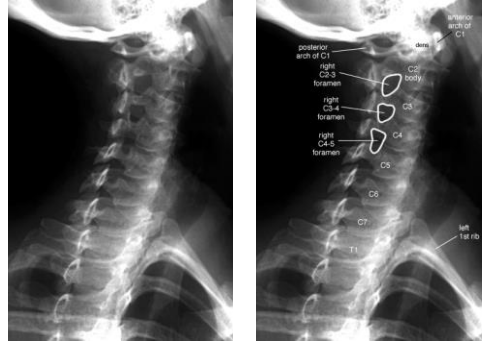
ML Richardson, Univ. Of Washington

Cervical Spine – Lateral View



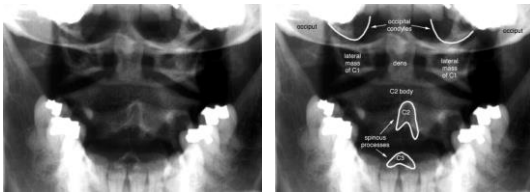
ML Richardson, Univ. Of Washington

Cervical Spine – Oblique View



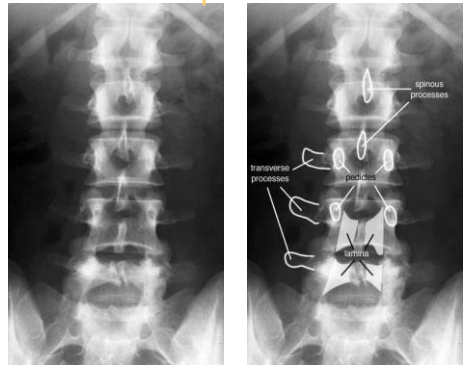
ML Richardson, Univ. Of Washington

Cervical Spine – Open-Mouth (Dens) View



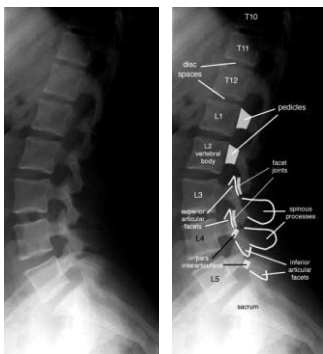
ML Richardson, Univ. Of Washington

Lumbar Spine – AP View

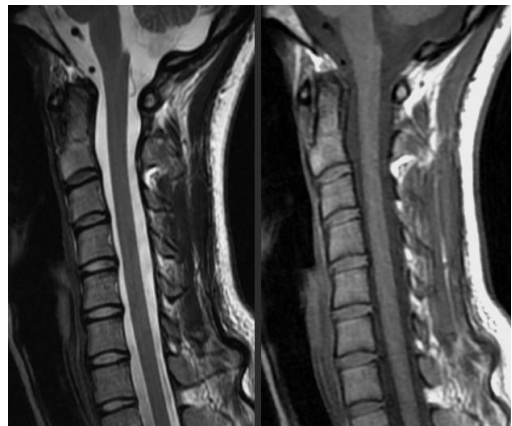


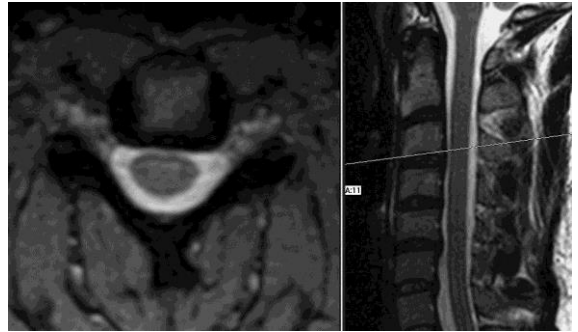
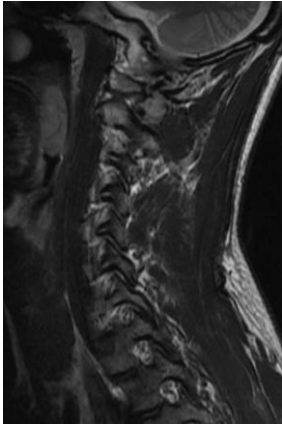
ML Richardson, Univ. Of Washington

Lumbar Spine – Lateral View



ML Richardson, Univ. Of Washington



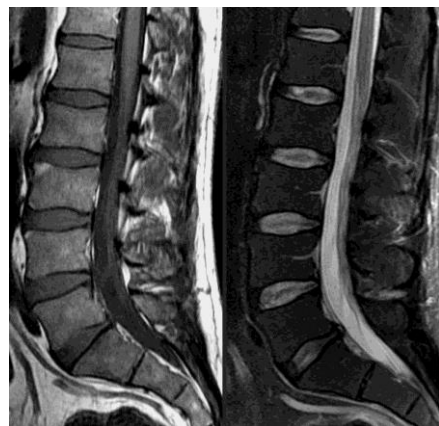


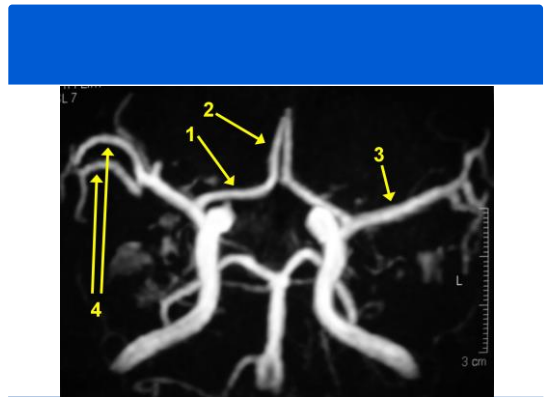
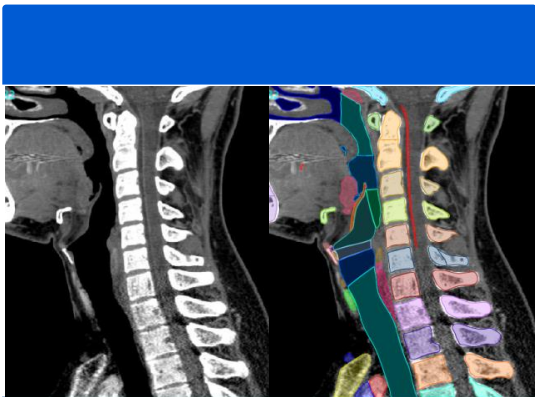
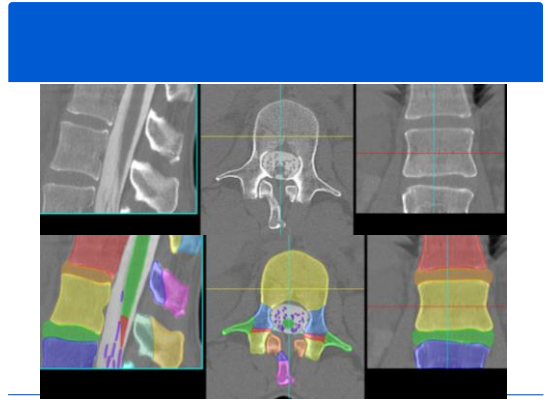
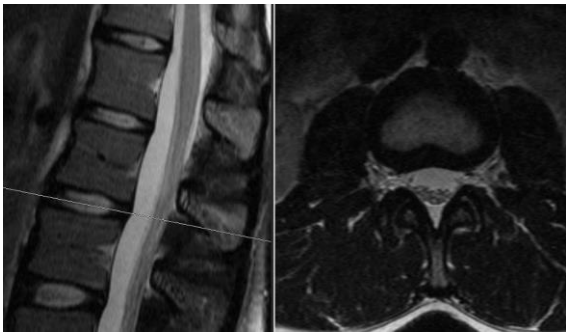
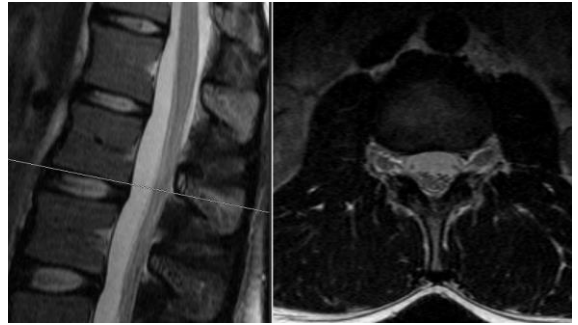
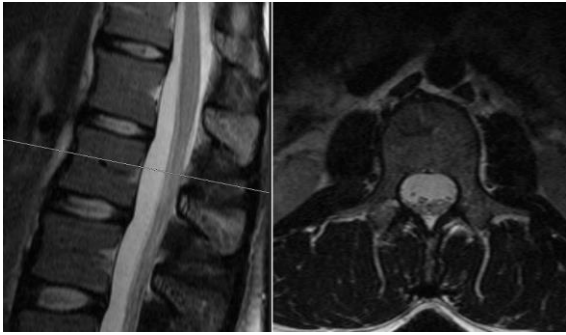
Sagittal Lumbar Spine

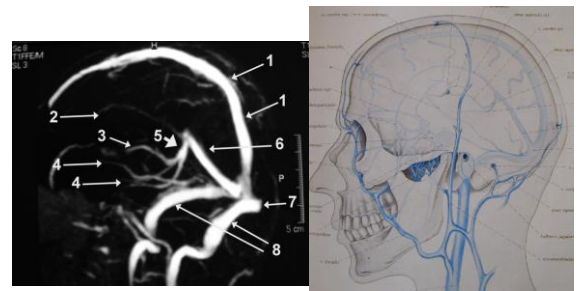
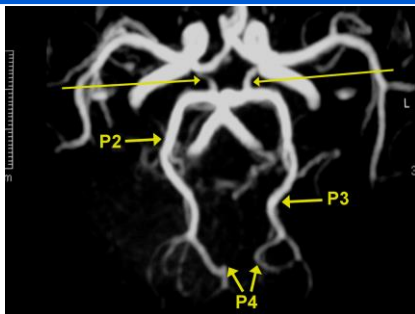
- Cauda equina
- Ligamentum flavum
- Epidural fat
- Spinous process
- Intraspinous ligament
- Dura
- Retrovertebral venous plexus
- Posterior longitudinal ligament
- Vertebral end plate
- Anterior longitudinal ligament
- Anulus fibrosus
- Nucleus pulposus

The Intervertebral Disk

Source: CW Keiber and JR Hesselink, Spine Anatomy, UCSD Neuroradiology





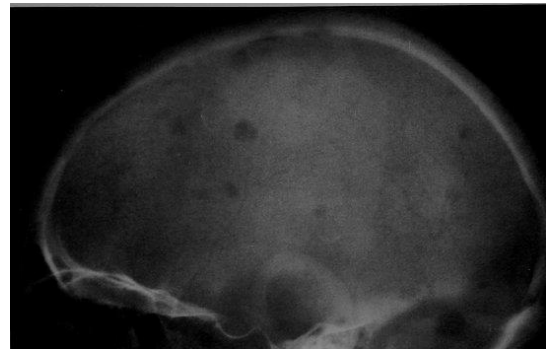
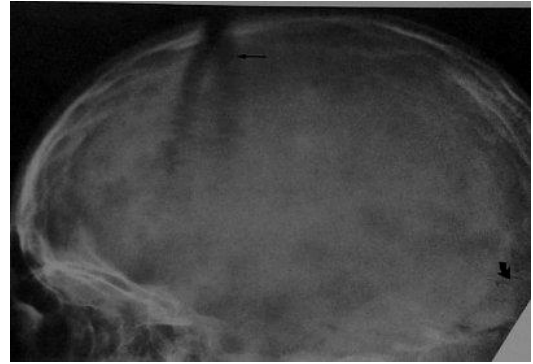
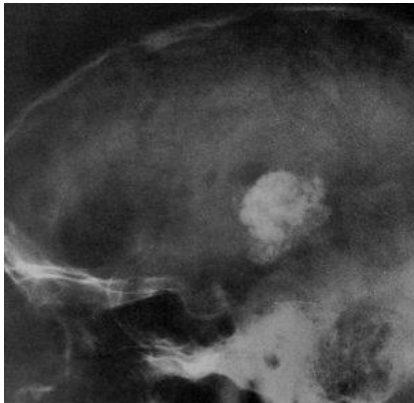


Imaging Modalities

- X-Ray 📷
- Computed Tomography (CT), ☢️
- Magnetic Resonance (MRI), 😊
- Ultrasonography (US), Doppler US 😊
- Angiography & Interventions ☢️

New Developments

- 3D imaging
- Multidetector CT
 - Fast
 - High resolution
 - CT angiography
 - CT perfusion
- New MR equipment
 - 1,5T to 3T or higher
 - MR angiography
 - Diffusion weighted imaging
 - Diffusion tensor imaging
 - Perfusion imaging
 - Functional imaging
 - MR spectroscopy



Computed Tomography (CT)

- Rule out
 - Trauma: Fracture, hemorrhage
 - Tumor: Herniation, hemorrhage, mass effect
 - Bony changes: Lysis, sclerosis, synostosis,
- CTA
 - carotid ASVD
 - *arch through circle of Willis*
 - intracranial ASVD, aneurysm
- CT perfusion
 - Rule out cerebral ischemia
 - Tumoral neovascularity

CT

- | | |
|---|---|
| <ul style="list-style-type: none"> • High-density <ul style="list-style-type: none"> • Calcifications • Fresh hemorrhage • C+ • Low-density <ul style="list-style-type: none"> • Tumor, infarct, ischemia • Atrophy • Fat (lipoma, dermoid) • CSF collections • Air | <ul style="list-style-type: none"> • Mass effect <ul style="list-style-type: none"> • Displacement • CSF obstruction • Bone lesions <ul style="list-style-type: none"> • Sclerotic • Lytic • CSF space enlargement <ul style="list-style-type: none"> • Hydrocephalus • Atrophy (local/generalized) |
|---|---|

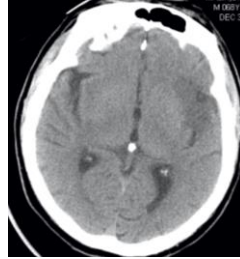
Blood



Calcification



Infarct



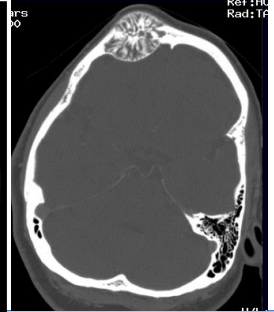
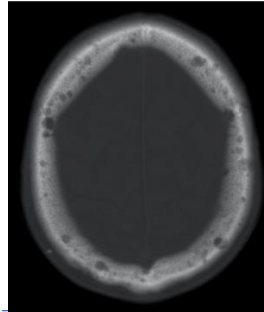
Abscess



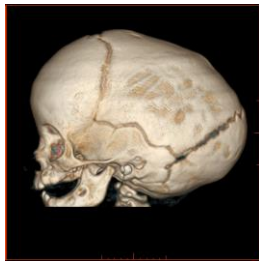
Tumor



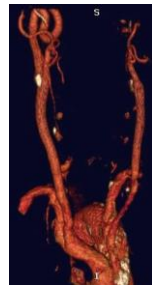
MM / Intradiploic meningioma



Craniosynostosis



CT Angiography (CTA)



Magnetic Resonance Imaging (MRI)

- **Pros**
 - High contrast resolution
 - Multiplanar imaging
 - Less bony artifacts
 - Tissue recognition
 - Fat, fibrosis, blood, edema,
 - Hemodynamic assessment
- **Cons**
 - Less available than CT
 - More expensive
 - Longer exam time
 - Not suitable for unconscious and claustrophobic pts
 - Weak at showing calcifications & acute hemorrhage

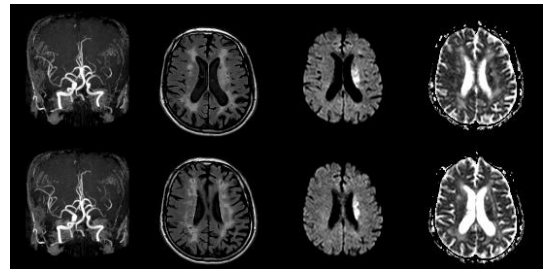
MRI

- Brain tumors: Grading, differentiation
- Metabolic & degenerative diseases
- Hemorrhage: Temporal evaluation
- Blood flow: Pathologic changes
- Cranial nerves
- Brain stem & cerebellum
- Pituitary
- Cranioservical junction
- Internal acoustic canal

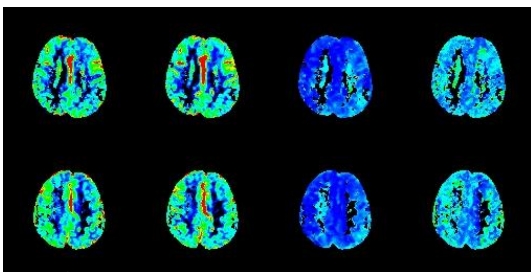
Advanced MRI Techniques

- **DWI & DTI**
 - Acute ischemia
 - Tumor vs abscess vs epidermoid
- **Perfusion imaging**
 - Ischemic penumbra and functional reserve
 - Brain tumor grading, Glioma vs Met
- **MRA**
 - carotid ASVD
 - intracranial ASVD, aneurysm
- **MR spectroscopy**
 - Tumor
 - Metabolic disease
- **Functional MRI (fMRI)**
 - In vivo assesment of cortical activation

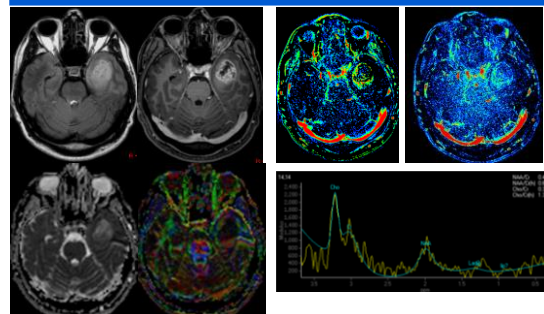
Acute infarct

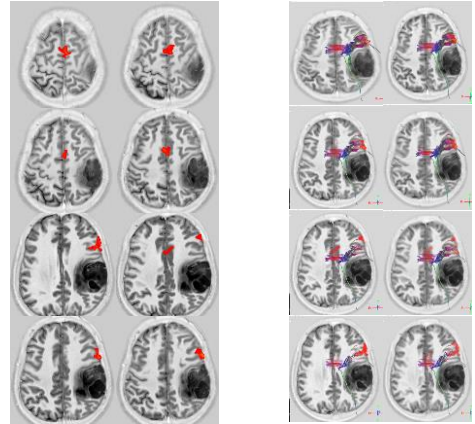
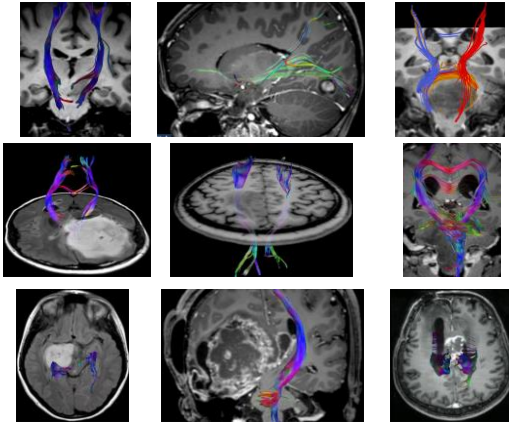


Penumbra



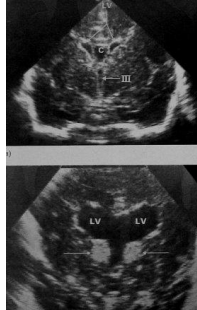
Brain tumor





Ultrasound

- Parenchymal and ventricular evaluation via open fontanel
 - Germinal matrix hemorrhage
 - Hydrocephalus
 - Brain anomalies
- Portable: Easily performed in couveuse



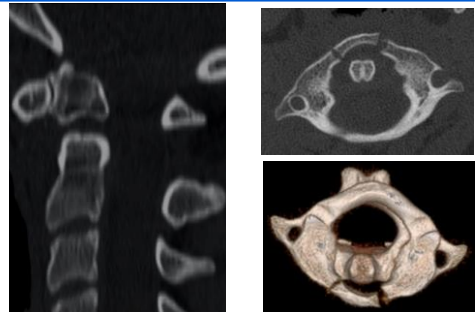
Angiography & Intervention

- Preop evaluation of vascular lesions
 - Localization
 - Feeding arteries
 - Draining veins
- Carotid and cerebral artery angioplasty, stenting
- Aneurysm, AVM embolization

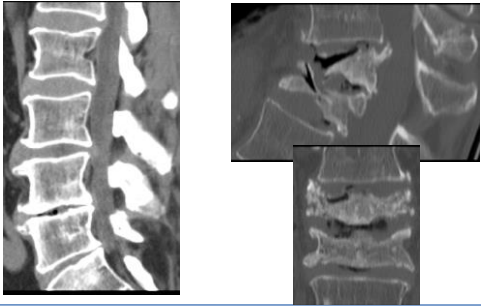
Spine

- X Ray: AP/L/Oblique
 - Vertebra & disc spaces
- CT & CTA
 - Vertebra, discs, vessels
- MRI & MRA
 - Vertebra, disc, vessels, meninges
 - Spinal cord & nerves
- Myelography
 - Spinal nerves, discs

Fracture



Degenerative disc disease



CT myelography



Spinal MRI



Spinal MRI

