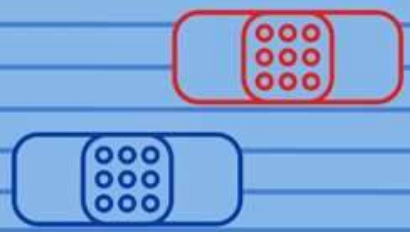
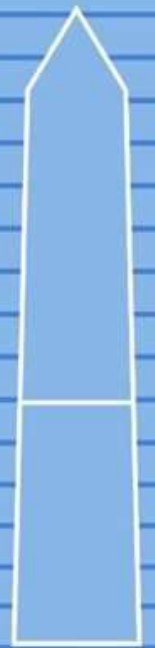


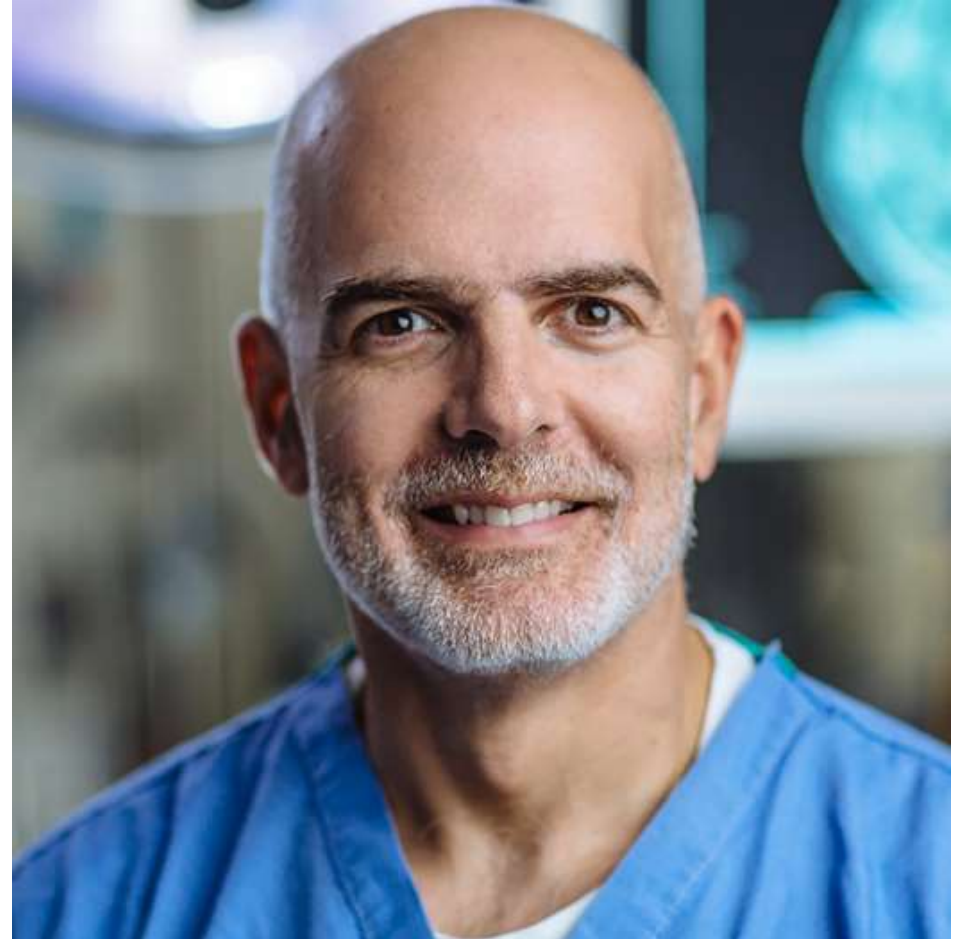
Future ^{OF} Pediatrics

Pediatric Health Network



Big Heads & Brain Tumors

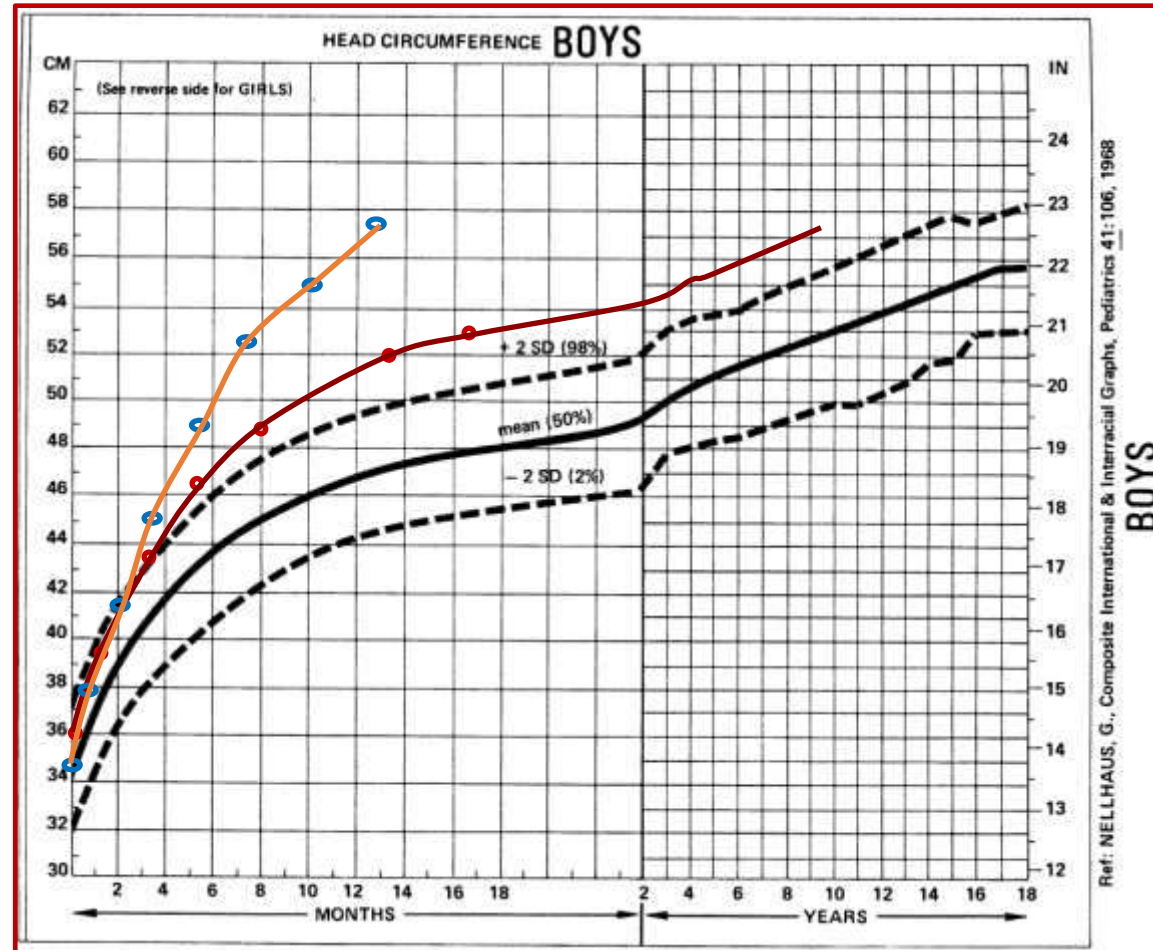
John Myseros, MD, FACS, FAAP
Vice Chief, Neurosurgery



Disclosures

NONE

Head Circumference



Benign Macrocephaly

Benign Enlargement of the Subarachnoid Spaces

- Excess CSF in frontal subarachnoid space
- Head growth acceleration early on
- Normal developmental milestones
- Re-establishment of large but normal head growth curve vs. [communicating hydrocephalus](#)
- Often familial

Pathologic Macrocephaly

- Hydrocephalus

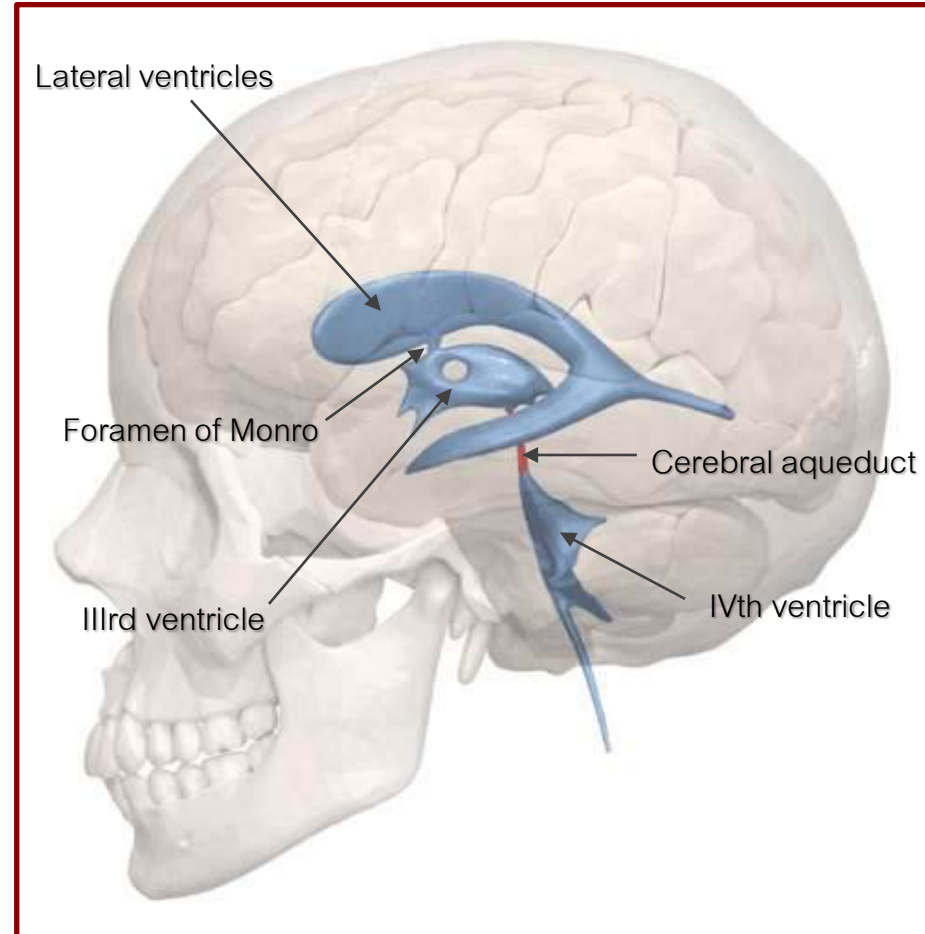
 - Arachnoid Cyst

 - Brain Tumor

Hydrocephalus - Definition

- Inadequate absorption (Communicating) or circulation (Obstructive) of cerebrospinal fluid resulting in increased intracranial pressure
- To be differentiated from [ventriculomegaly](#)

Ventricular Anatomy



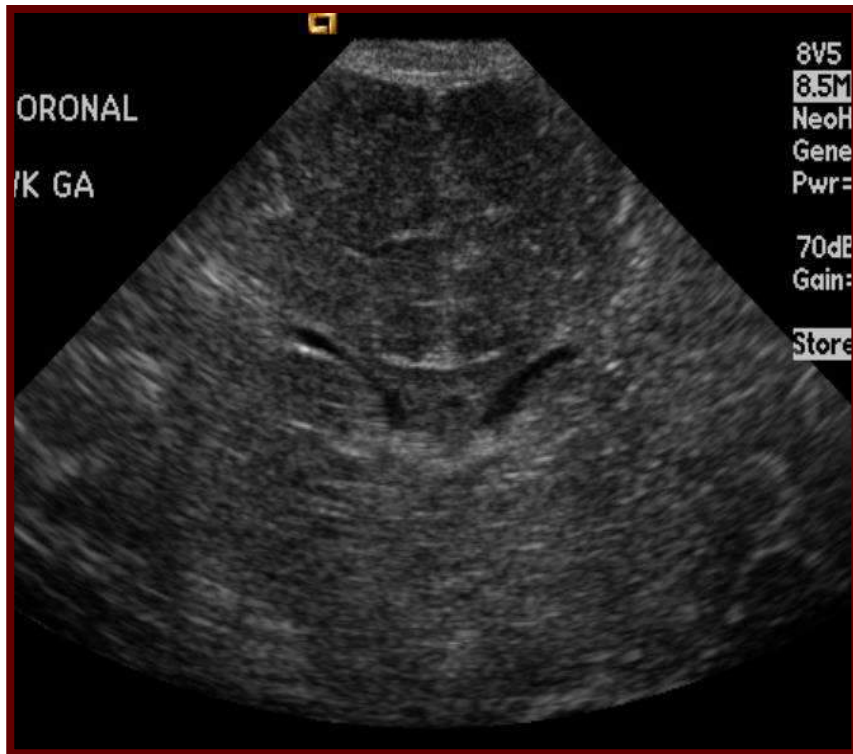
Acquired Hydrocephalus

- Prematurity and IVH
- Post-natal infection – meningitis
- Post-traumatic hydrocephalus
- Arachnoid or porencephalic cysts
- Brain tumors

Grade III GMH-IVH Early

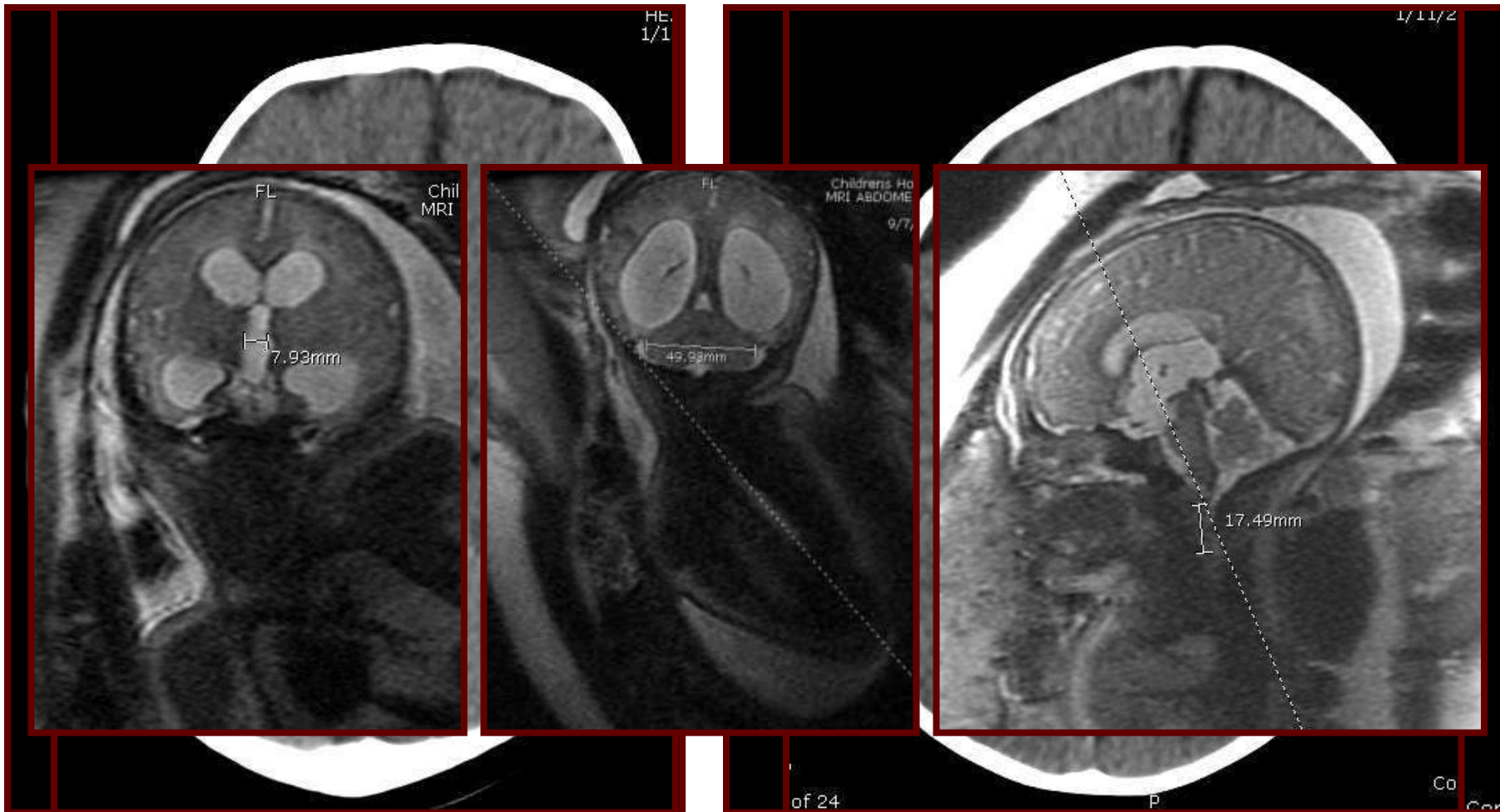


Grade III GMH-IVH Later



Congenital Hydrocephalus

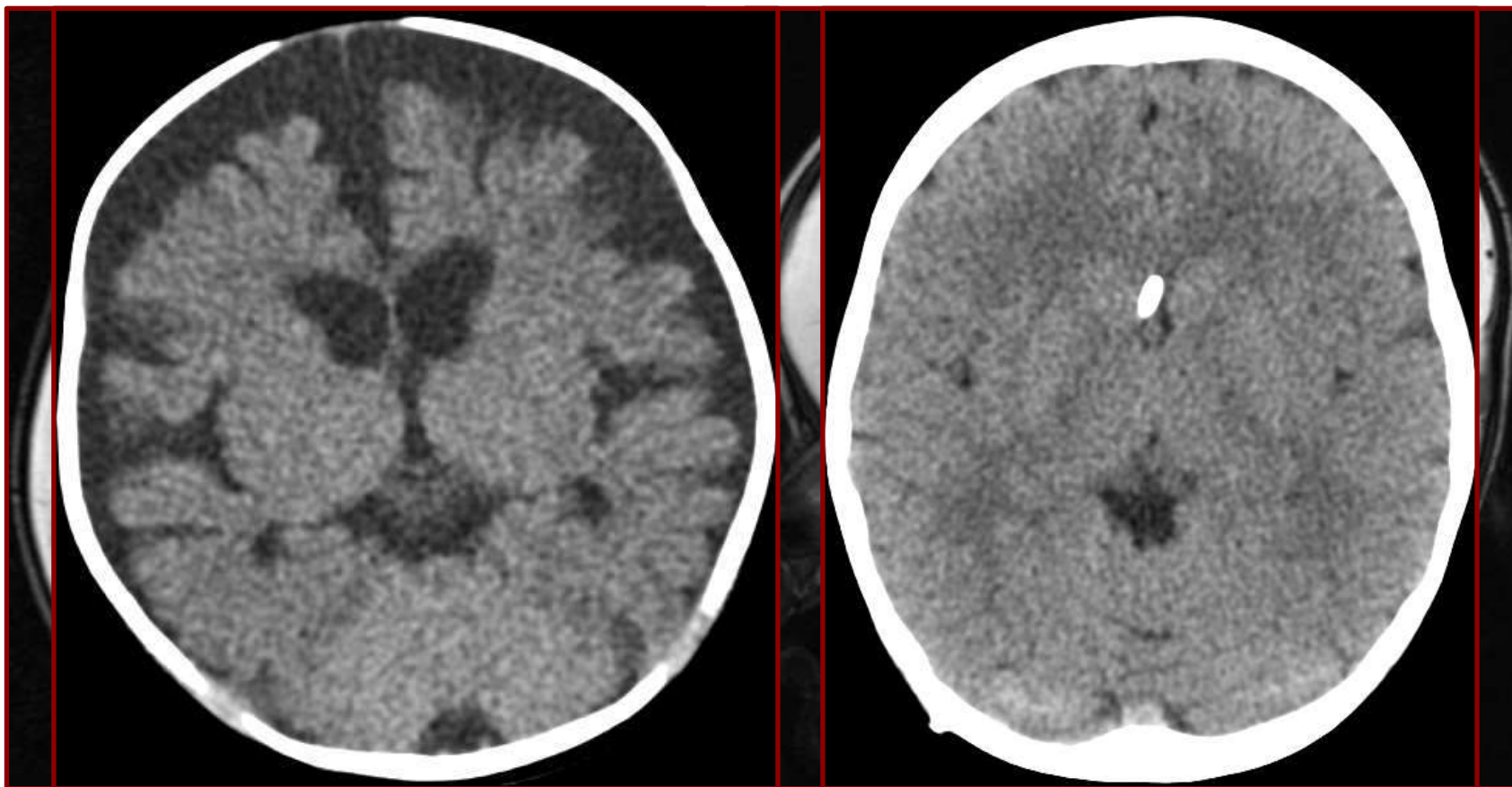
- 4-10 / 100,000 births
- Intra-uterine
- In-utero infection
- Aqueductal stenosis- (small number x-linked)
- Myelodysplasia
- Dandy-Walker malformations
- **Prenatal screening**



Communicating Hydrocephalus

- Normal circulation
- Dilated ventricles including IVth
- Absorptive deficit at the level of arachnoid granulations
- Amenable to access from spinal subarachnoid space

Communicating



Patient JC

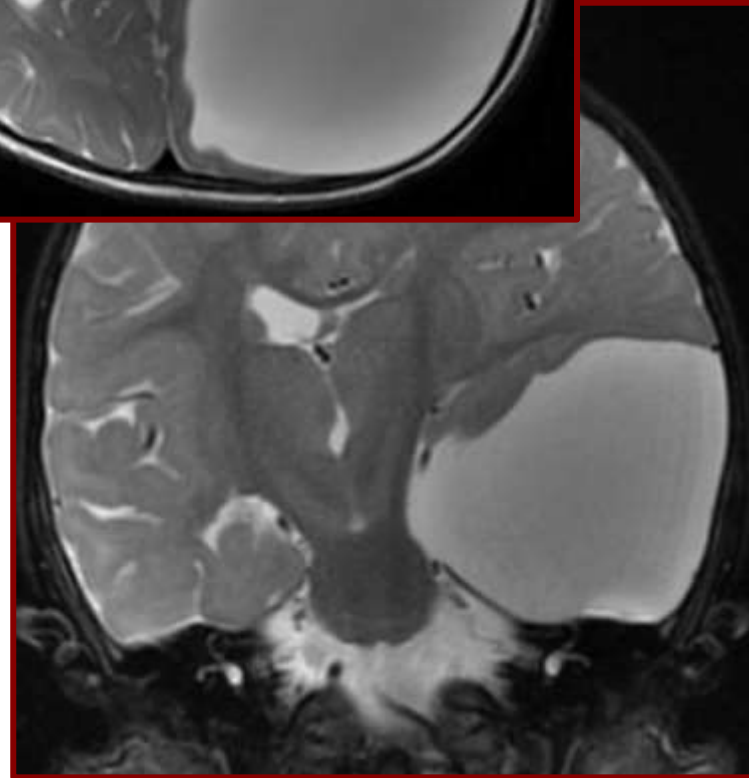
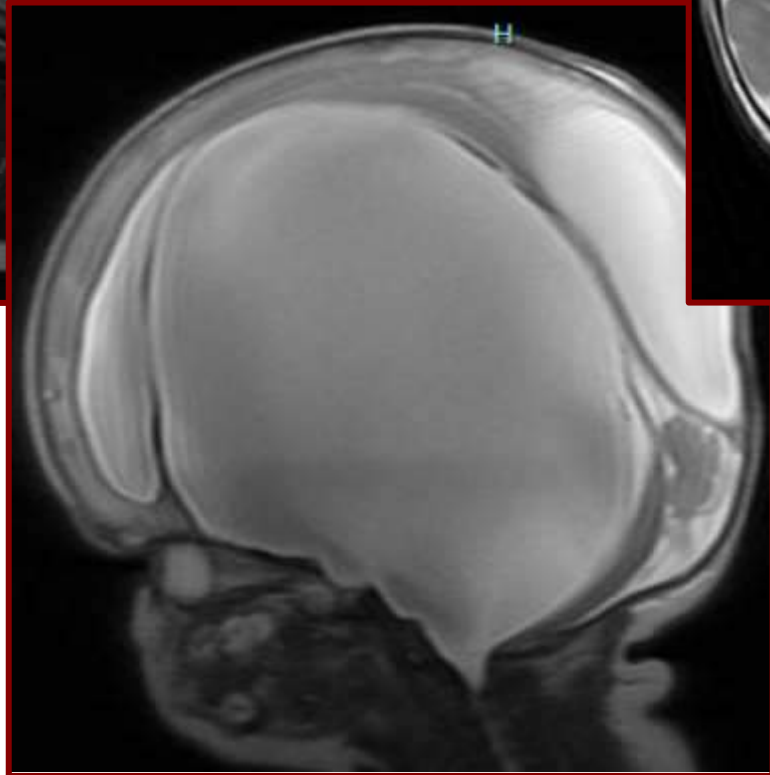
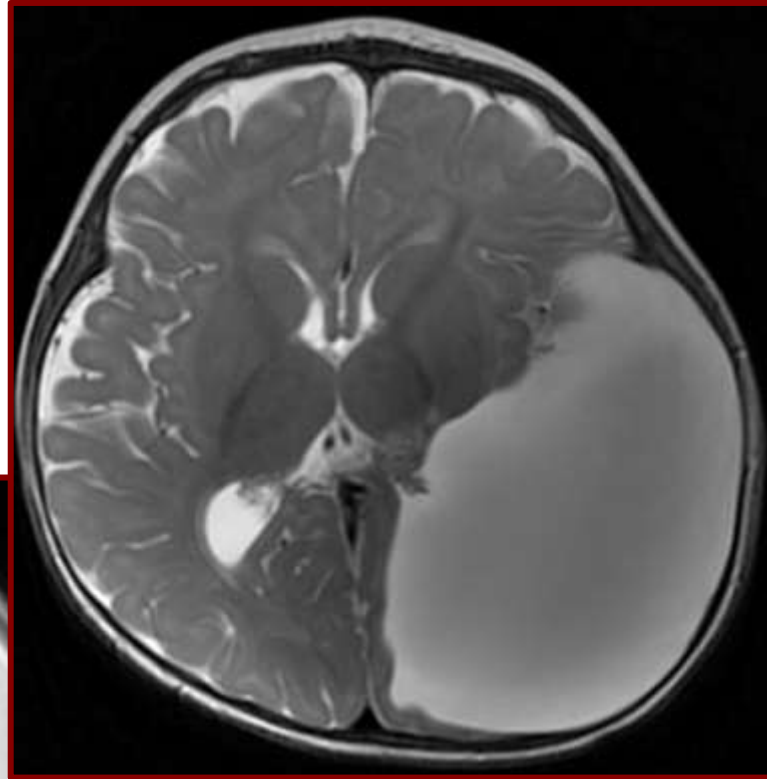
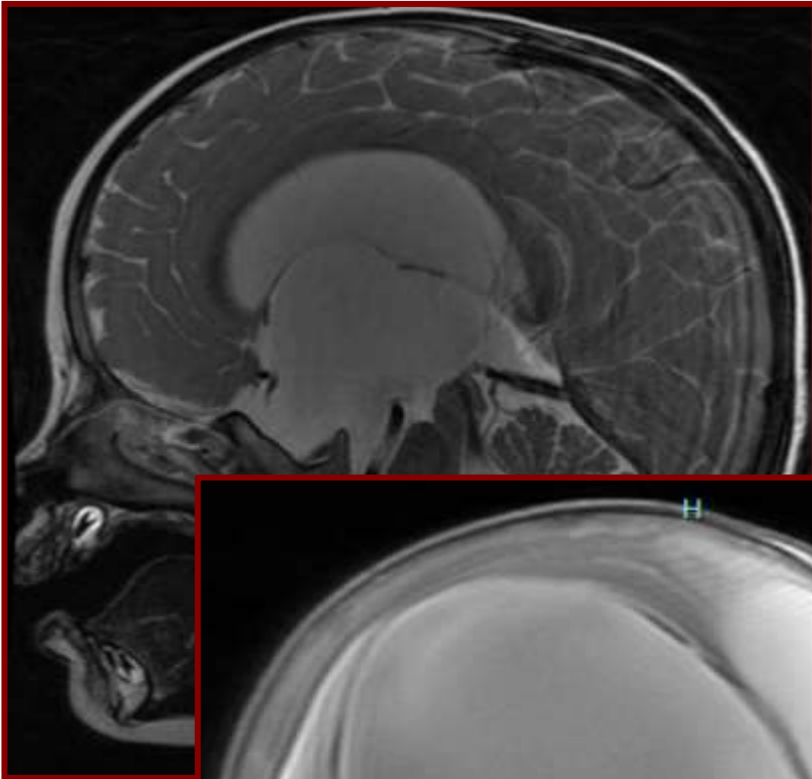
- 12 month
- Macrocephaly
- Persistent head growth acceleration
- Not sitting, not walking
- Happy
- SOFT fontanelle

Patient JC



Arachnoid Cyst

- CSF trapped
- Redundant arachnoid
- Incidental- typically temporal fossa
- Treatment
 - Shunt
 - Fenestration



Patient JG

- 3-month-old boy with head growth acceleration
- Full fontanelle
- Asymptomatic

JG - Imaging





Brain Tumors in Children

- Cancer is 2nd cause of death in children < 15
- CNS tumors are 2nd most common neoplasm
- The most common solid tumors in children
- 20 - 25% of all childhood cancers
- Deadliest childhood cancer
- About 5000 new brain tumors in ages 0-19 per year

Histopathology

- Astrocytoma, incl. diffuse pontine glioma
- PNET: Medulloblastoma, ATRT
- Craniopharyngioma, Pituitary tumors
- Germ cell tumors- +/- germinoma
- Ependymoma
- Other intraventricular tumors
 - papilloma, meningioma, central neurocytoma

Location of Tumor

- Supratentorial
- Infratentorial
- Sellar/Suprasellar
- Pineal Region



Presentation - Supratentorial

- Anatomic neurologic deficit
 - Visual problems - VF, VA
 - Speech
 - Sensorimotor
 - Gerstmann's syndrome
- Obstructive hydrocephalus / Headache
- Seizure

Presentation - Posterior Fossa

- Obstructive hydrocephalus / Headache
- Vomiting - particularly in the morning
- Ataxia
- Cranial neuropathy - diplopia
- Nystagmus

Presentation – Pineal

- Obstructive hydrocephalus
- Parinaud's syndrome

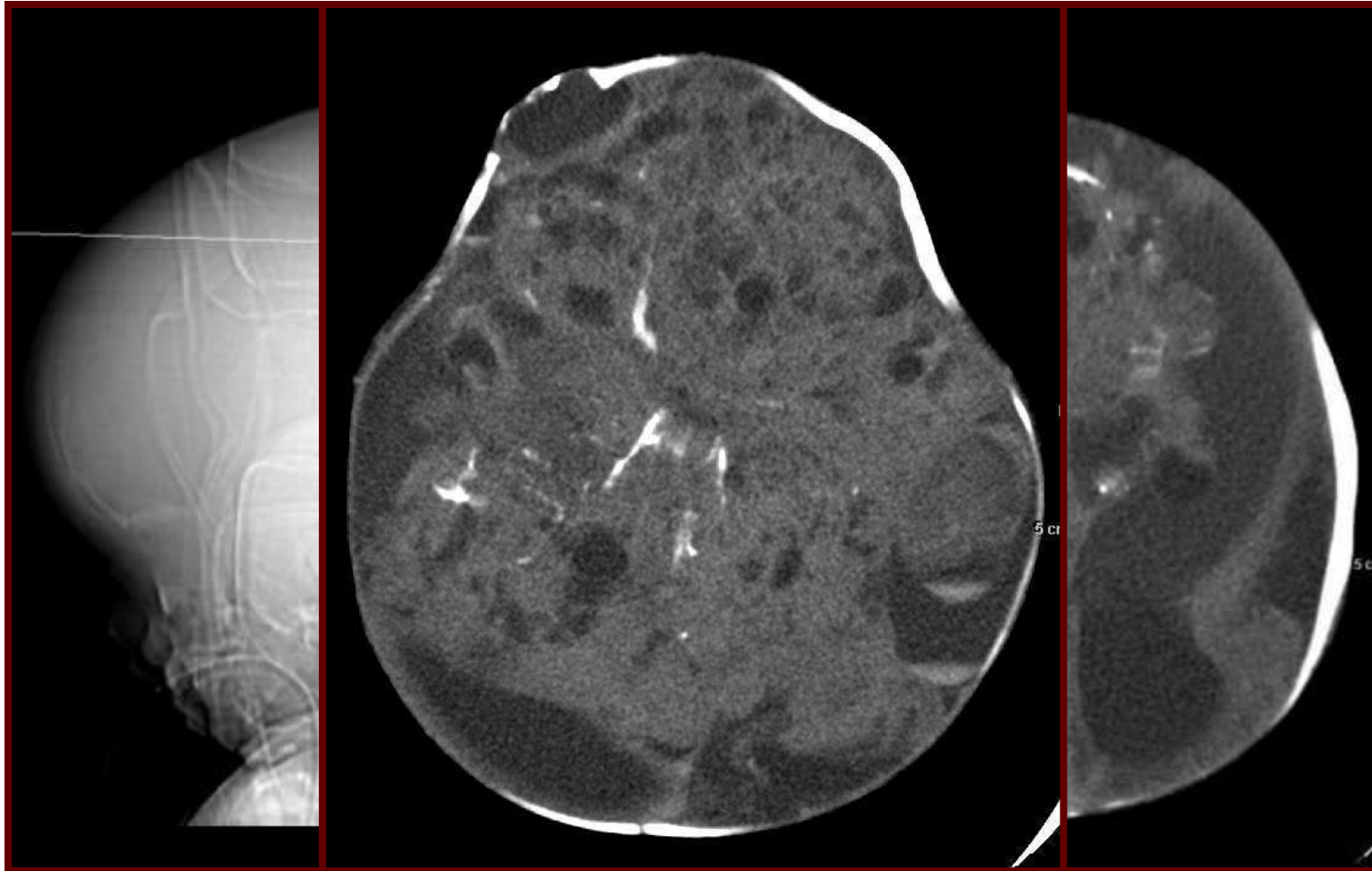
Presentation - Suprasellar

- Visual field or acuity deficits
- Endocrinopathy
- Hydrocephalus
- Diencephalic syndrome

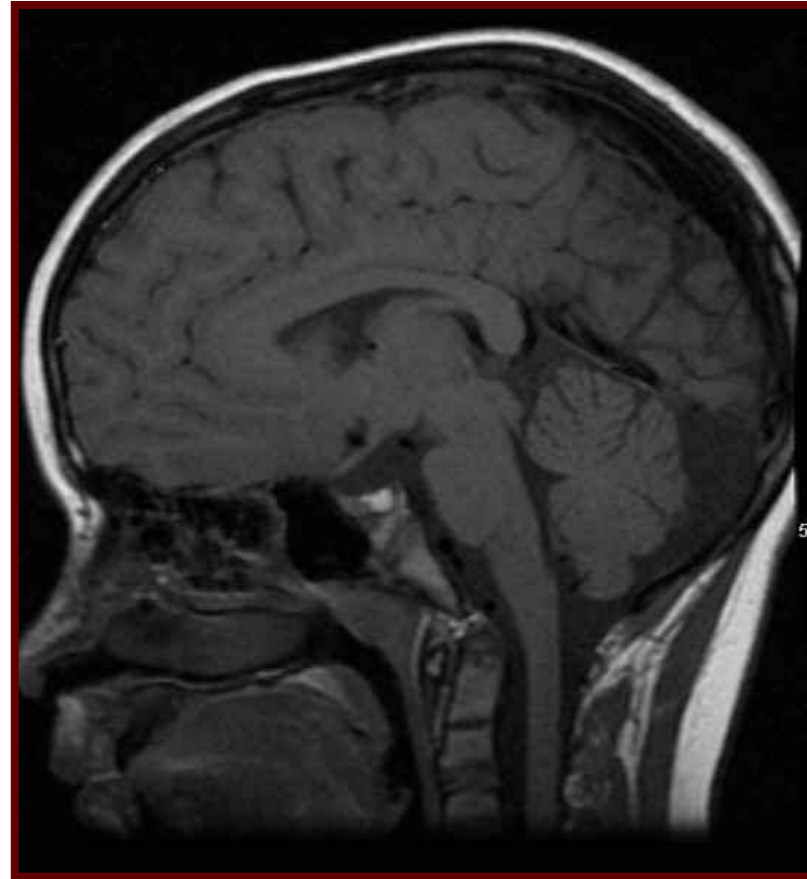
Surgery - Aims

- Relieve increased intracranial pressure
- Establish a diagnosis
- Subtotal vs. Gross total resection
- Avoid neurologic deficit
- Relieve hydrocephalus

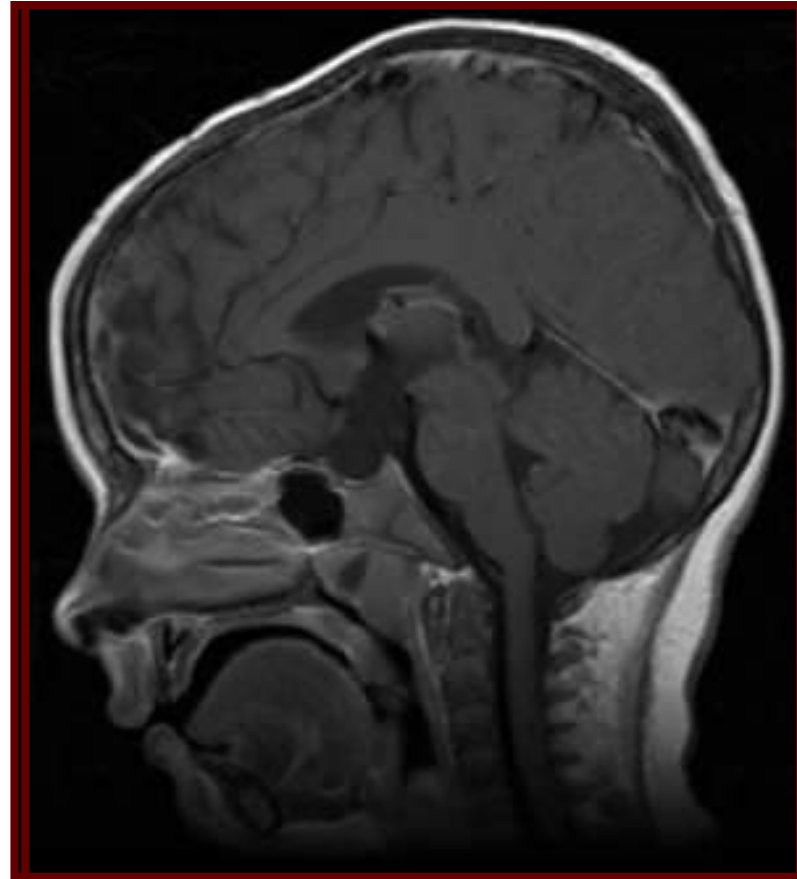
Fetal Brain Tumors



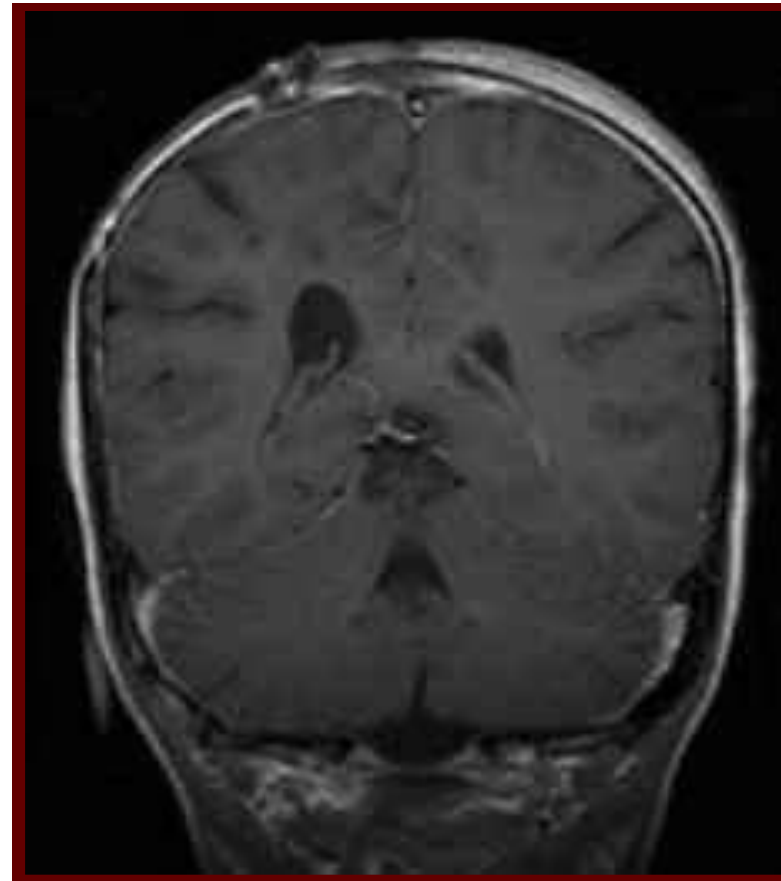
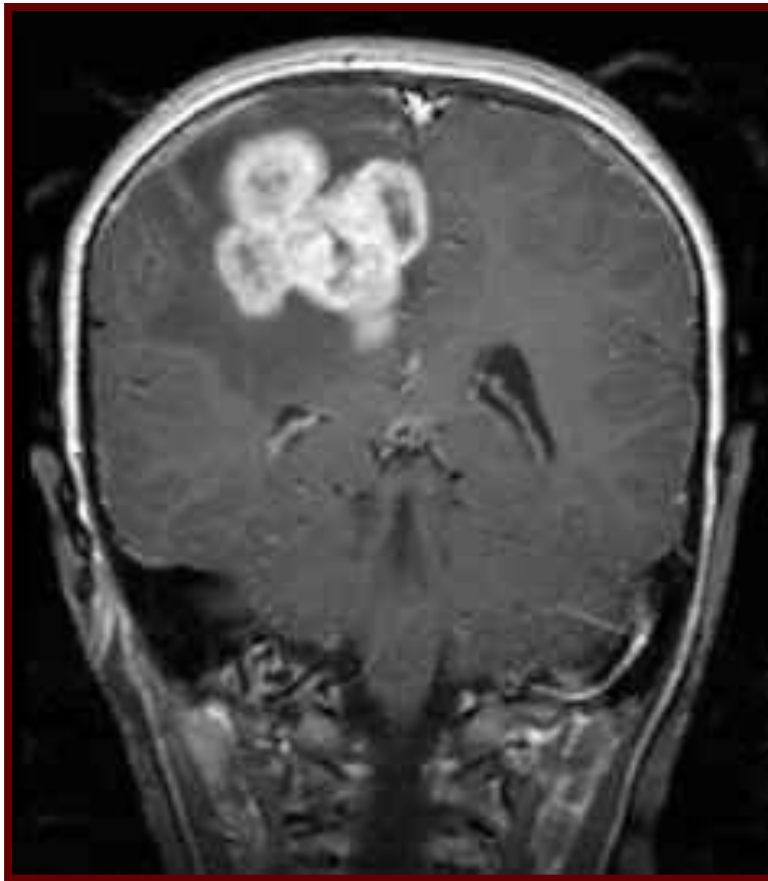
Pituitary Tumor



Craniopharyngioma



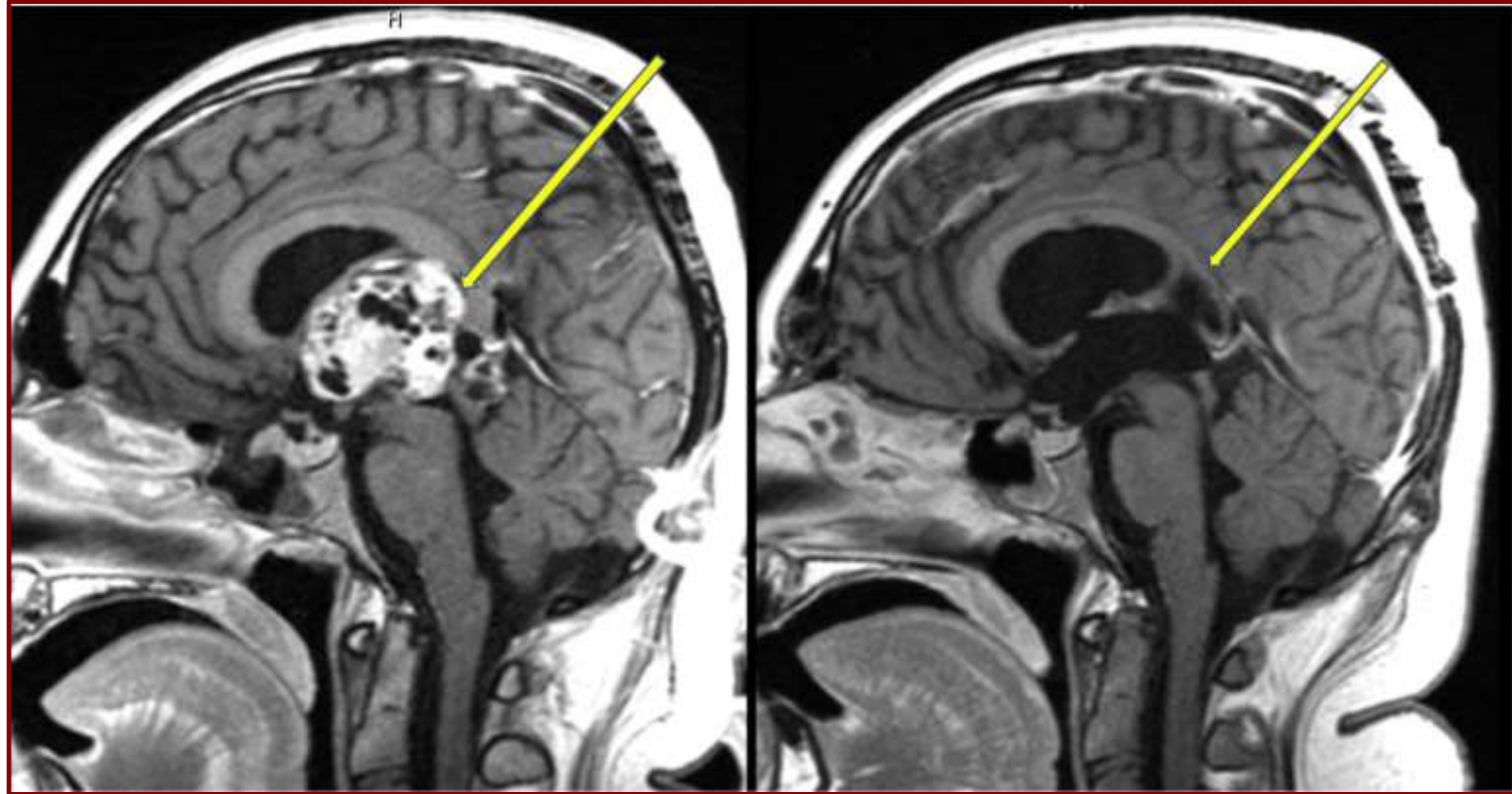
Ependymoma



Medulloblastoma



Pineal Tumor



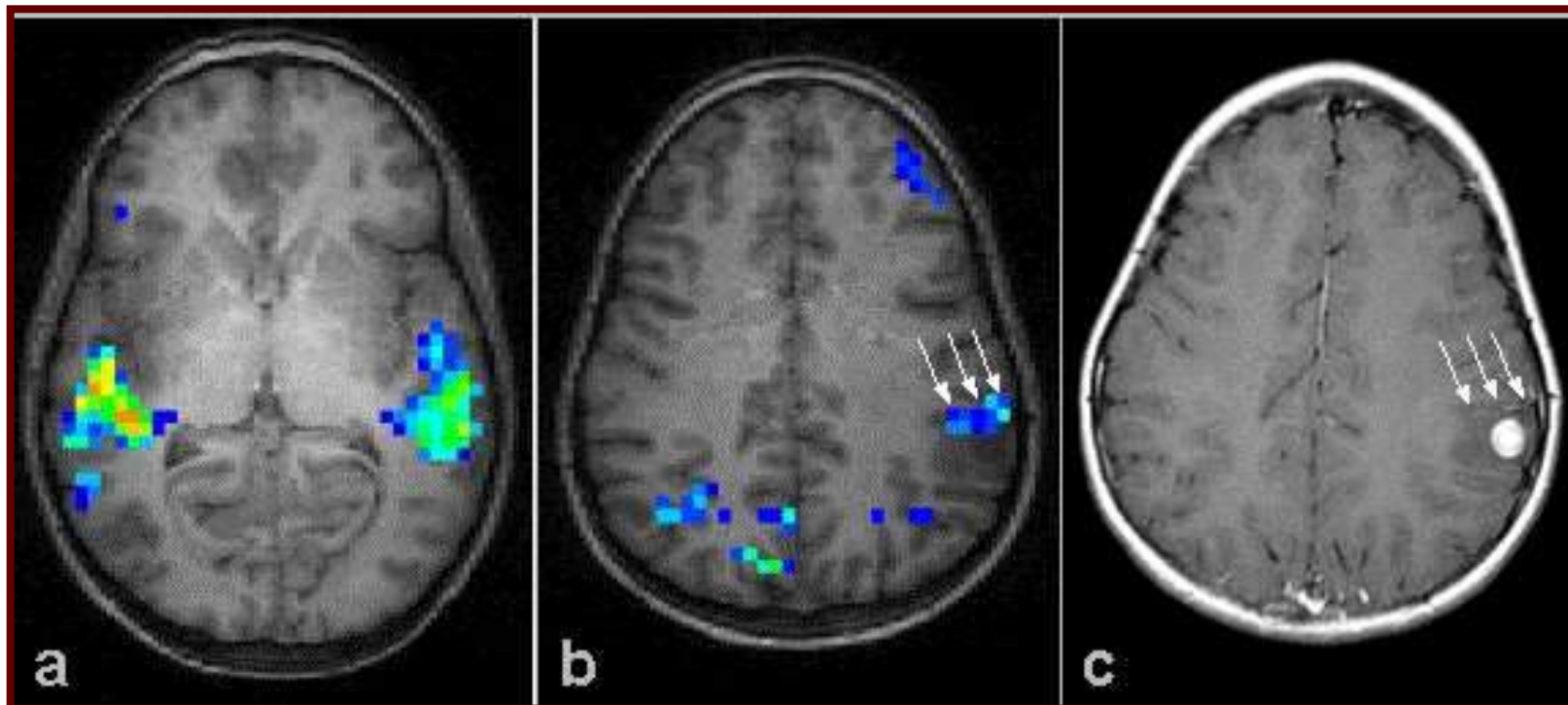
Improvement

- Intra-operative imaging
 - CT, MRI, Ultrasound
- Functional imaging
 - Functional MRI, Tractography
- Chemo/Biological/Immuno Therapies
- Radiation- stereotactic, Proton Beam
- Endonasal endoscopic skull base

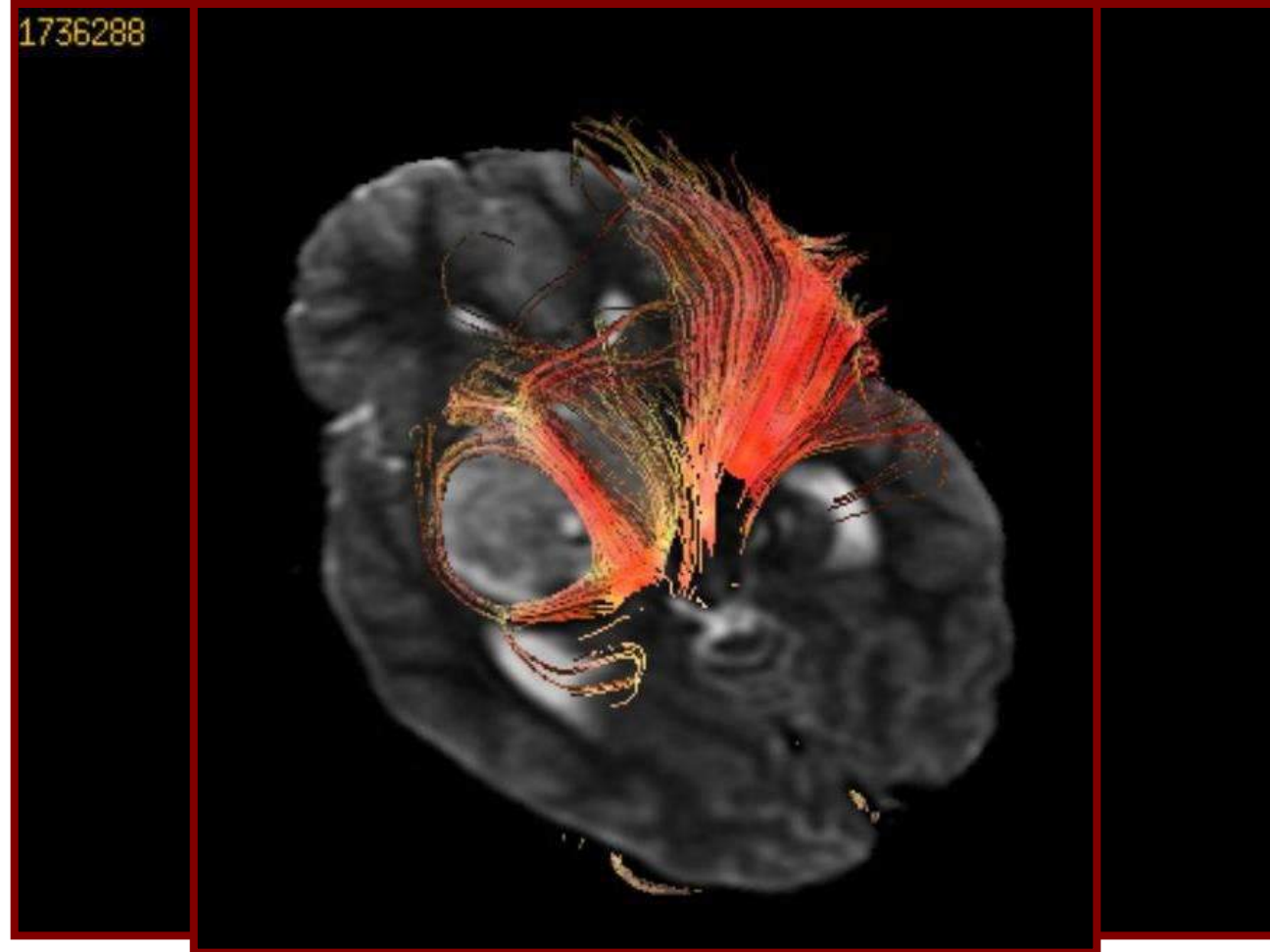
Intra-operative Imaging



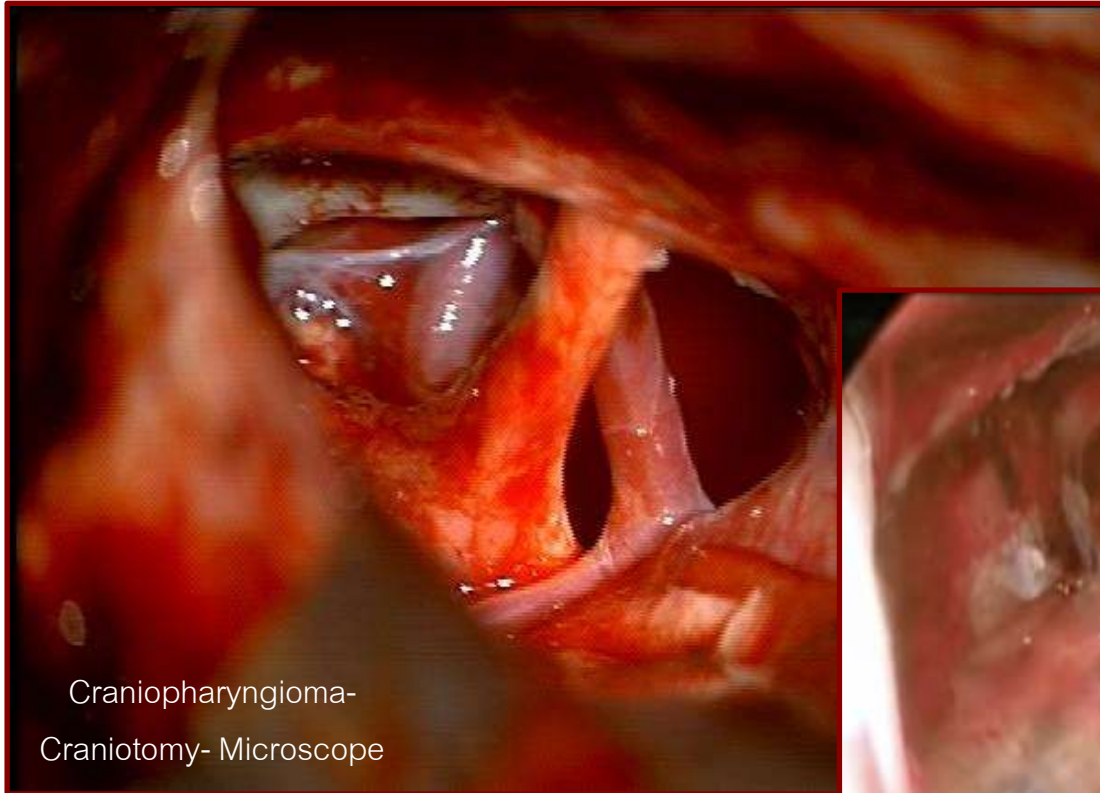
Functional MRI



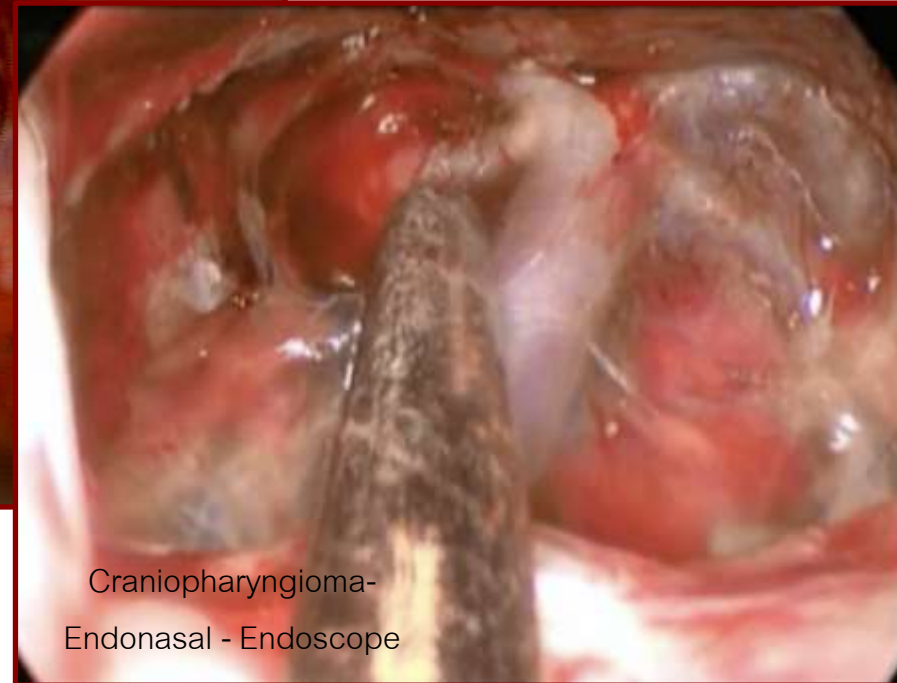
Diffusion Tensor Imaging



Endoscopic Endonasal

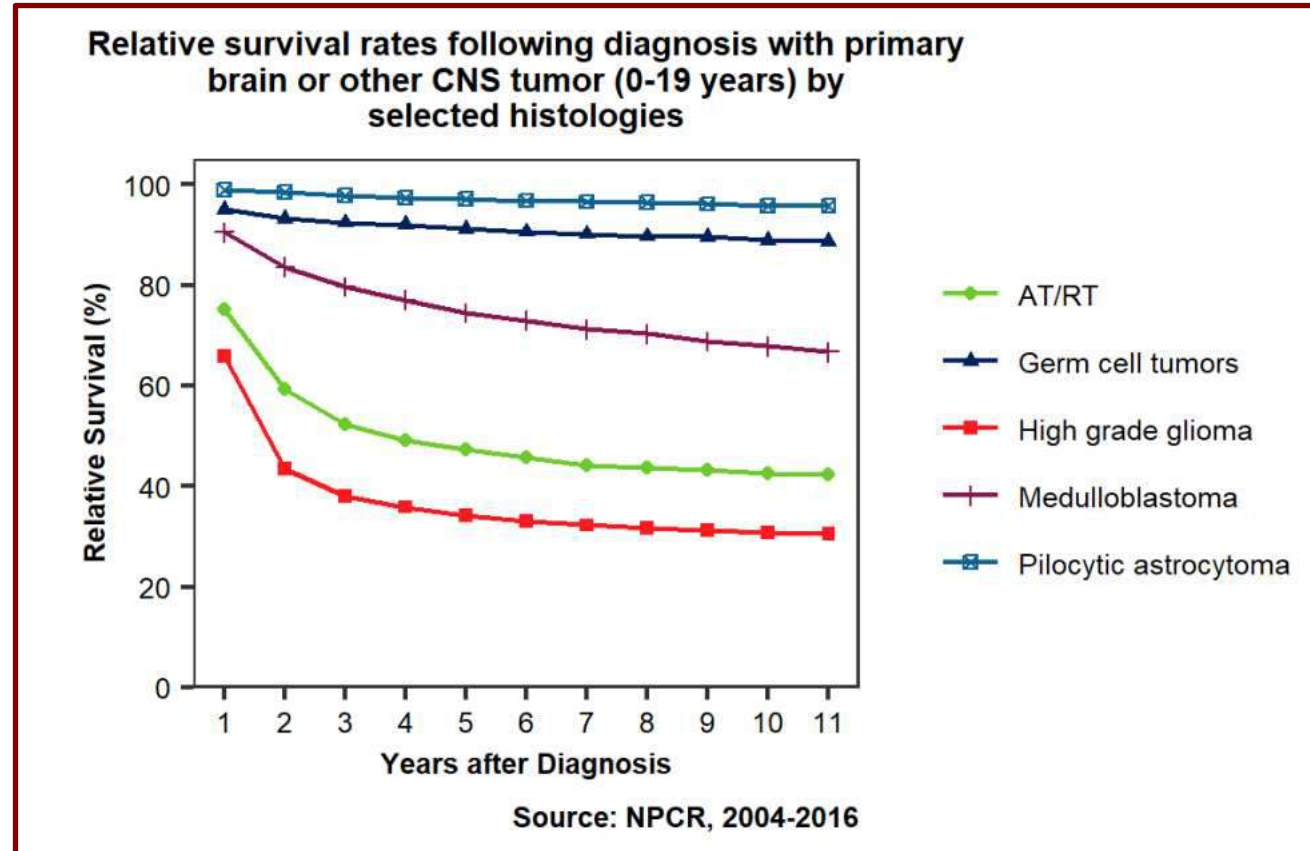


Craniopharyngioma-
Craniotomy- Microscope

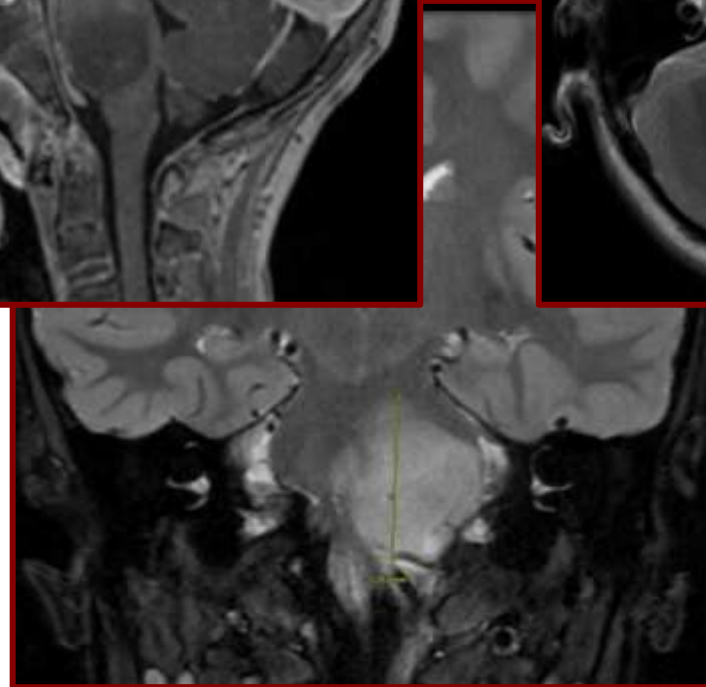
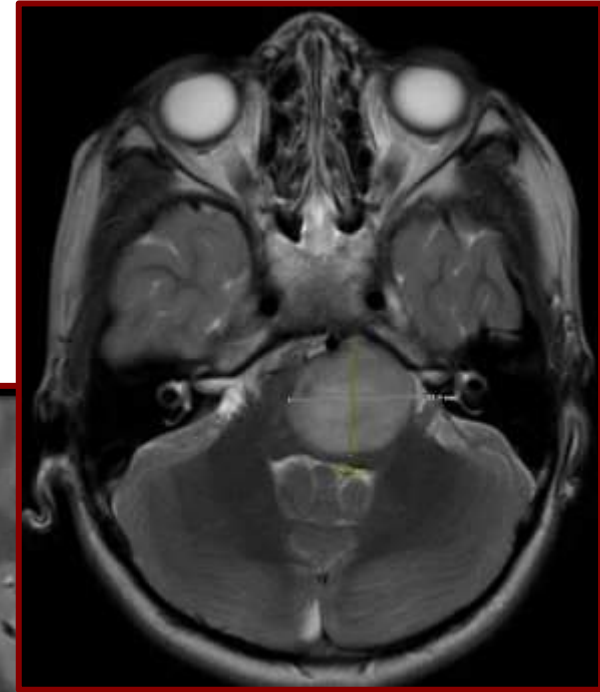
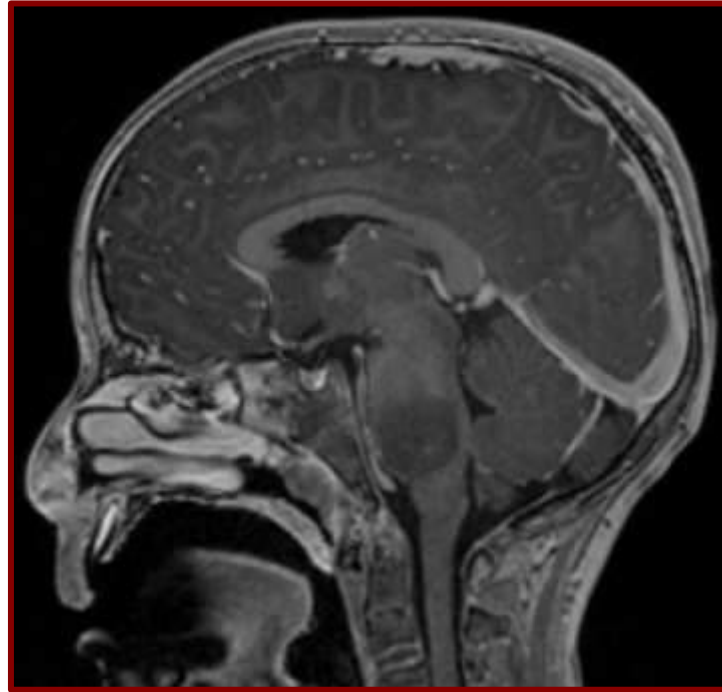


Craniopharyngioma-
Endonasal - Endoscope

Pediatric Brain Tumor Survival

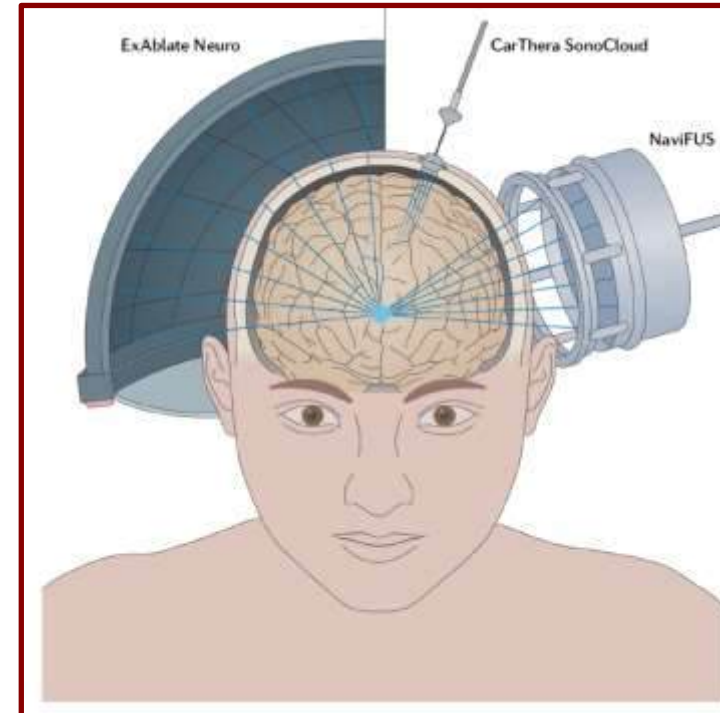


Diffuse Intrinsic Pontine Glioma



Focused Ultrasound

- Non-invasive ultrasonic waves to heat, ablate, modulate, or activate tissue
- Focused via curved transducer, lens or phased array, such that the pressure is highest at a small target
- Non-invasive, “incision-less”
- MRgFUS: marriage of 2 innovative technologies



Meng et al. *Nature Reviews*, 2021.

Focused Ultrasound

- Low Intensity Focused Ultrasound (LIFU)
 - Sonodynamic therapy - DIPG
 - BBB disruption – delivery of doxorubicin - DIPG
- High Intensity Focused Ultrasound (HIFU)
 - Ablation of benign, centrally-located tumors

When should we order a scan and what type of scan?

- Seldom do we see tumors present as isolated seizure or headache
- Worsening headache, morning H/A, morning vomiting
- New onset or progressive neurologic deficit
- In the very young- symptoms of increased intracranial pressure

Thank You

