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Pediatric neurosurgery – brain tumors

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- Introduction
- Definition of pediatric brain tumors
- Epidemiology
- Importance of early diagnosis and treatment

Pediatric vs. Adult population

Localization – supra vs. infratentorial, brainstem

Histology

Adults – meningiomas, gliomas, metastases, pituitary adenomas

Pediatric – pilocytic astrocytoma, medulloblastoma, ependymoma

Something to remember

1

Pediatric brain tumors are not staged

2

They do not metastasize, except via CSF (“drop metastases”)

3

MR imaging – brain & spine

4

How serious a brain tumor is, depends on its grade & size & location

Diagnosis – clinical symptoms

Depends on age

Weight loss, poor feeding, mental status changes

Macrocephaly

Cerebellar symptomatology – dystaxia vs. gait disturbances

Eye movement disorders

Cranial nerves palsy

Morning headache, that goes away after vomiting

Frequent nausea

Seizures

Iritabilty vs. lethargy

Diagnostics – clinical symptoms

Headache & vomiting – most common symptoms in childhood

6 months = average period from the beginning of symptoms to diagnosis verification

25% children with posterior fossa tumors undergo a complete gastroenterological investigation

Posterior Fossa & Brainstem Tumors - Clinical Features

Posterior Fossa primary

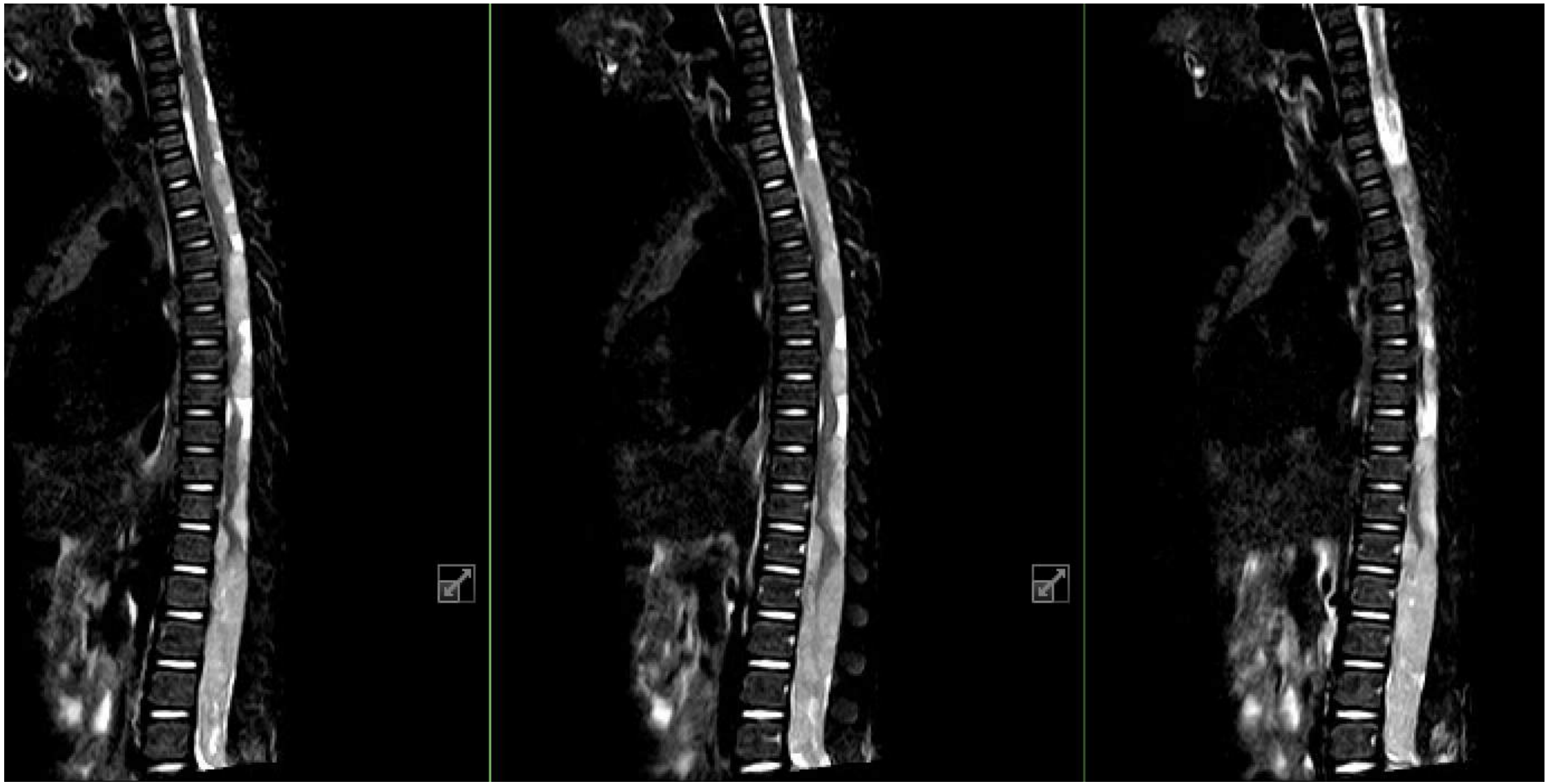
- Ataxia
- Tremors
- Dysarthria
- Stiff neck
- Papilledema

Brainstem primary

- Extremity weakness
- Cranial nerve signs
  - double vision
  - facial weakness
  - swallowing dysfunction

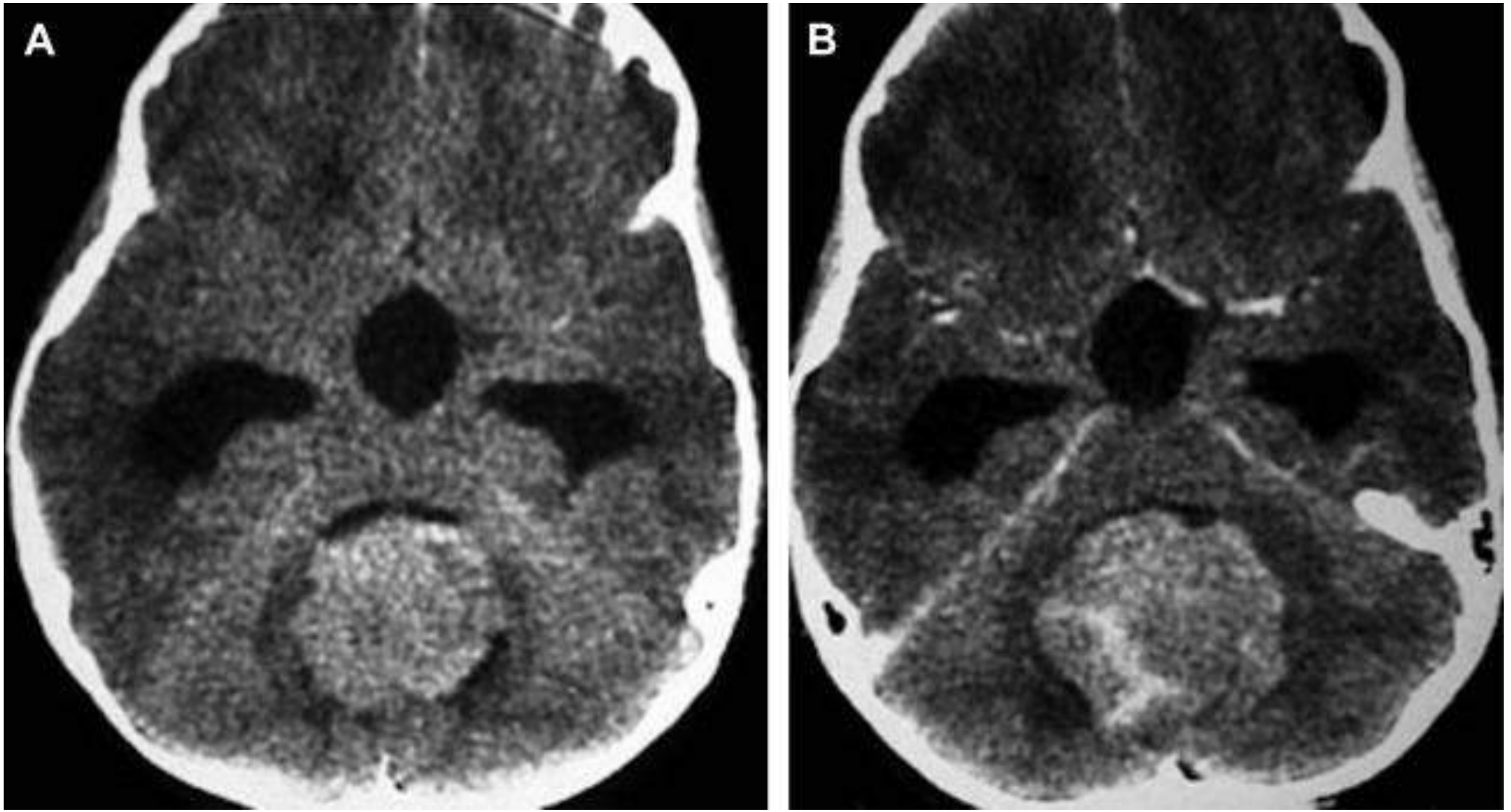
Diagnostics

- Papilledema
- Cave! – Lumbar puncture
- Drop metastases – MR brain & spine
- Tumor markers – AFP, β-HCG, PLAP



Diagnostics

- MR
- Intraaxial vs. extraaxial
- Localization, size of the tumor and its relationship to the brain tissue
- Enhancement
  - Typical for high grade tumors
  - Cave! pilocytic astrocytoma
- 90% successful rate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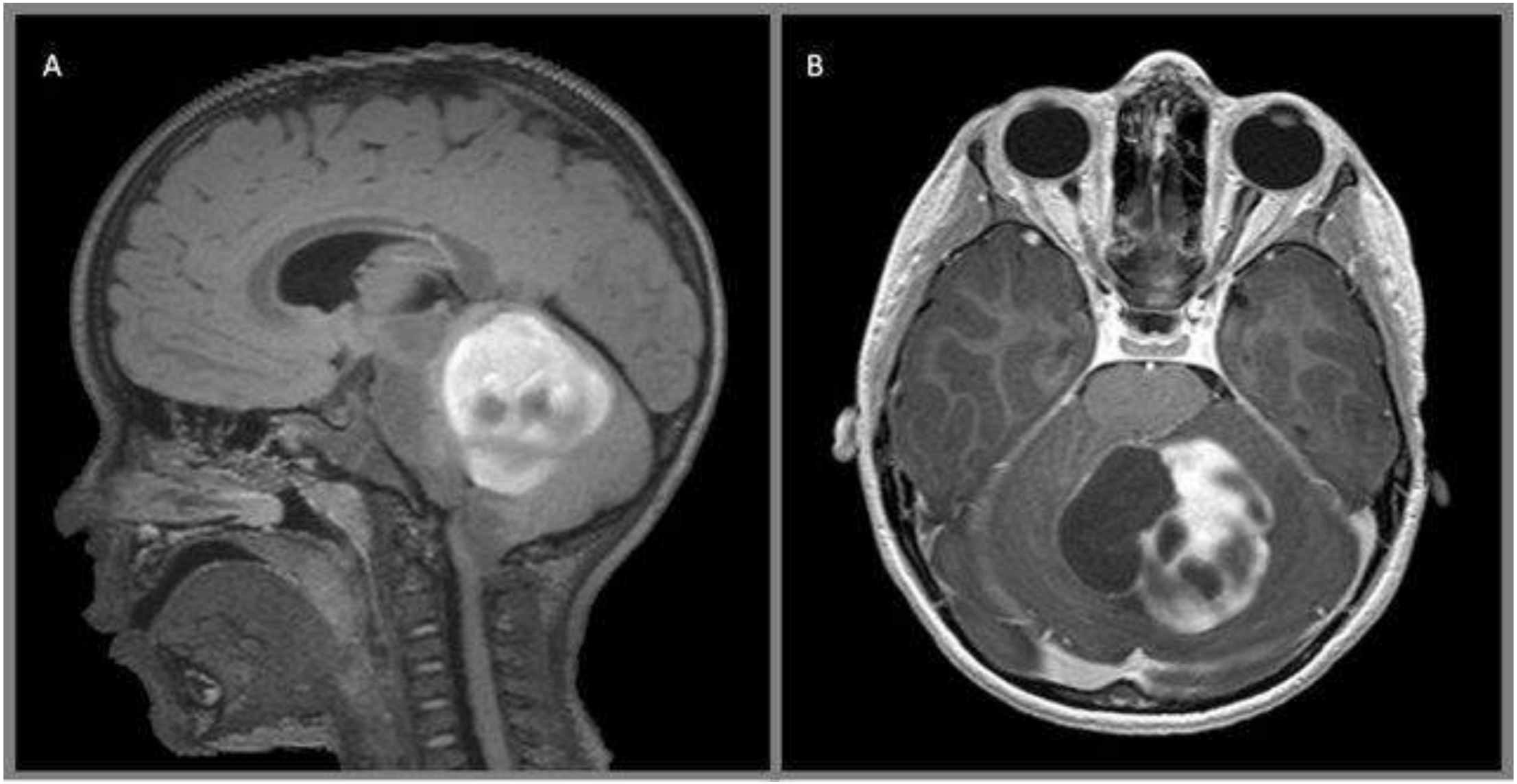
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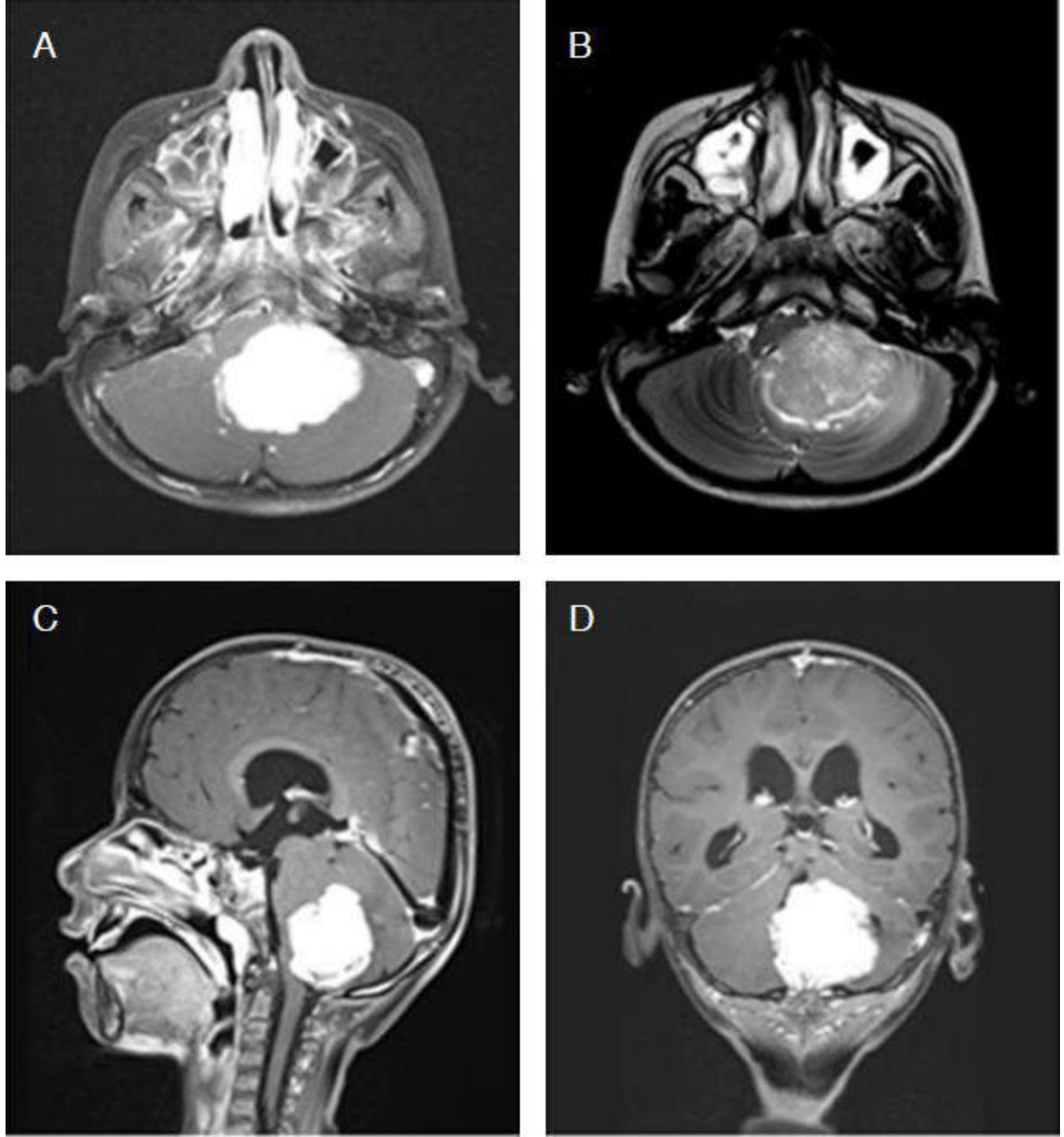
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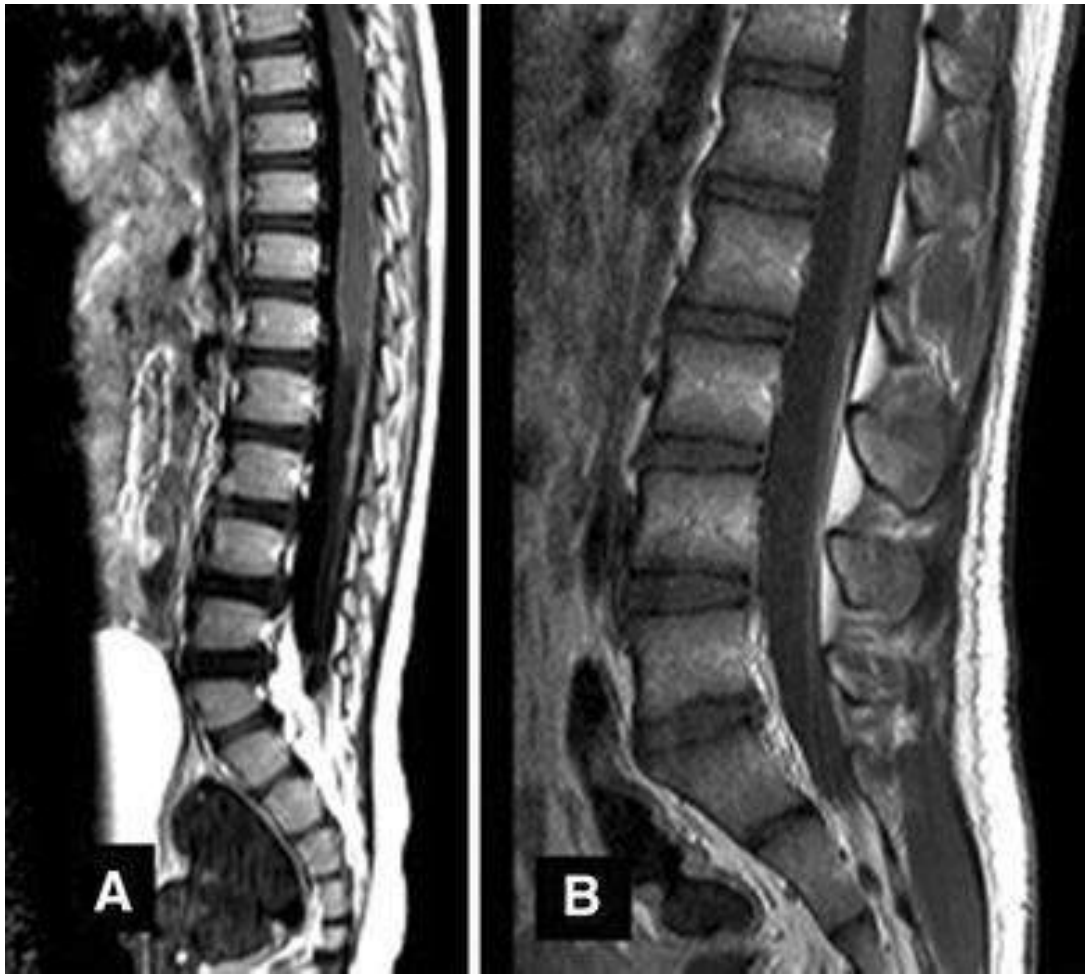
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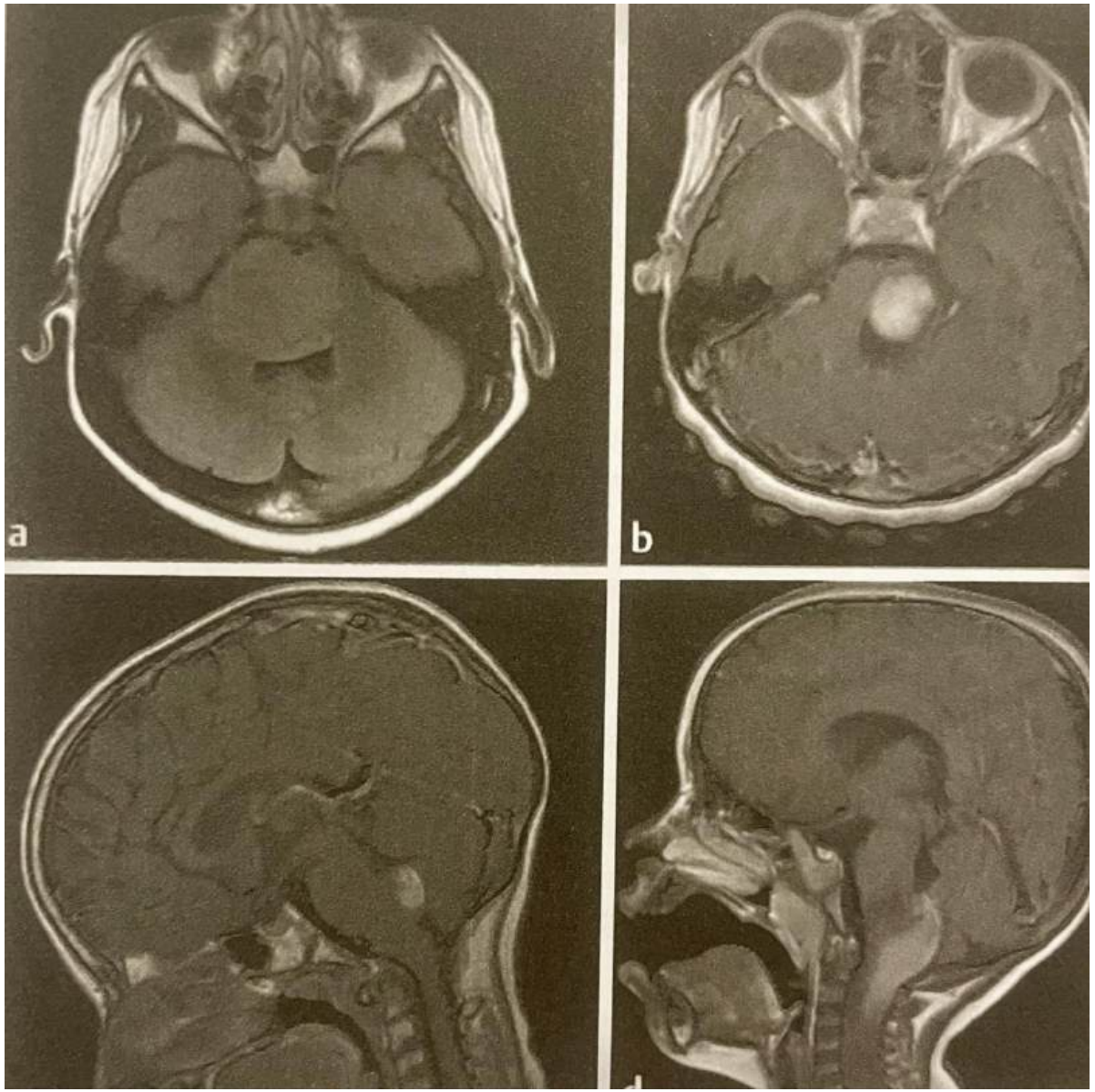
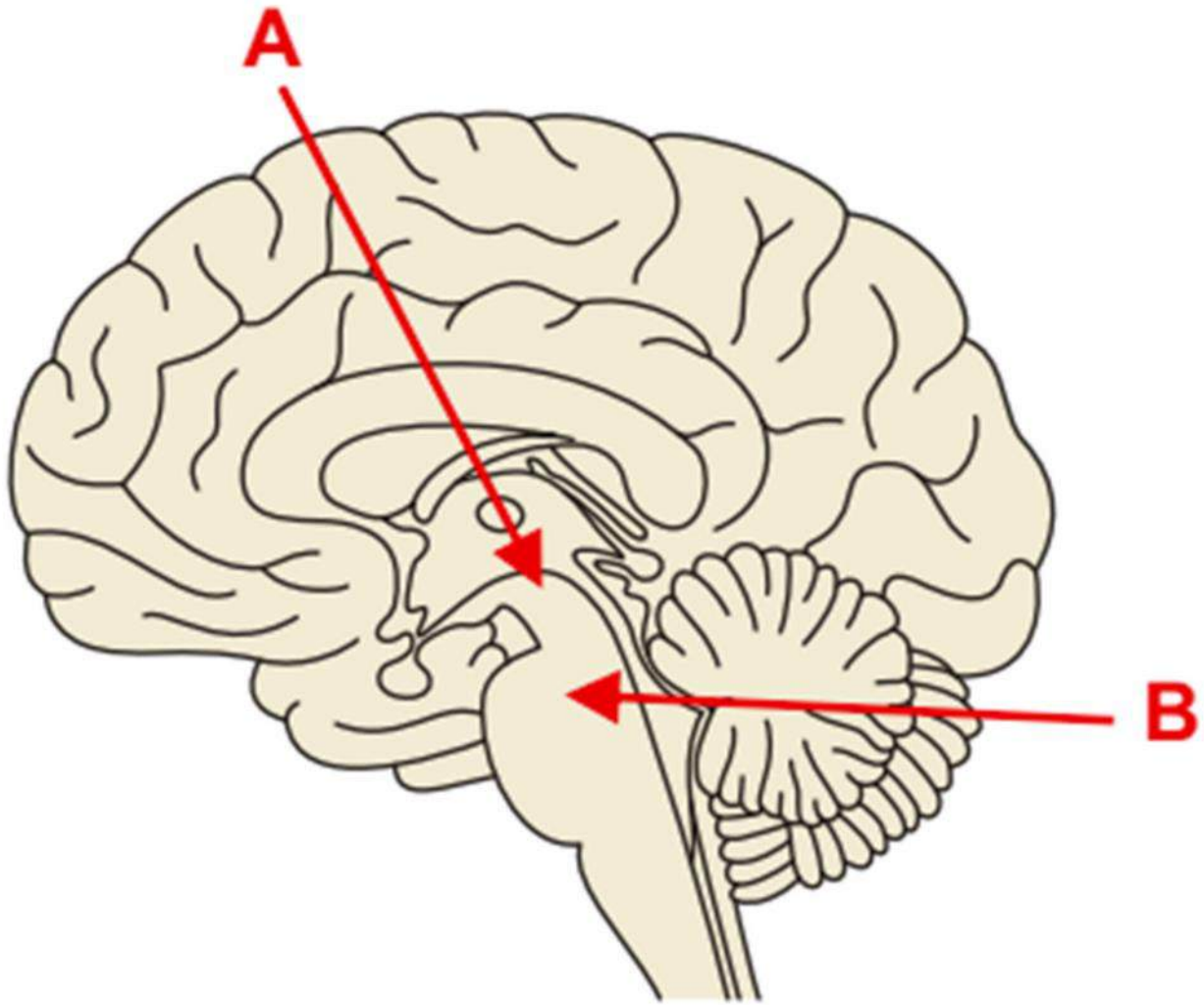


Brainstem gliomas

- 6 – 15 years
- Atypical clinical manifestation
- Enhancement ±
- median survival = 6-9 months
- Mortality > 90%
- Biopsy
- Radiotherapy could lead to the temporary iclinicalimprovement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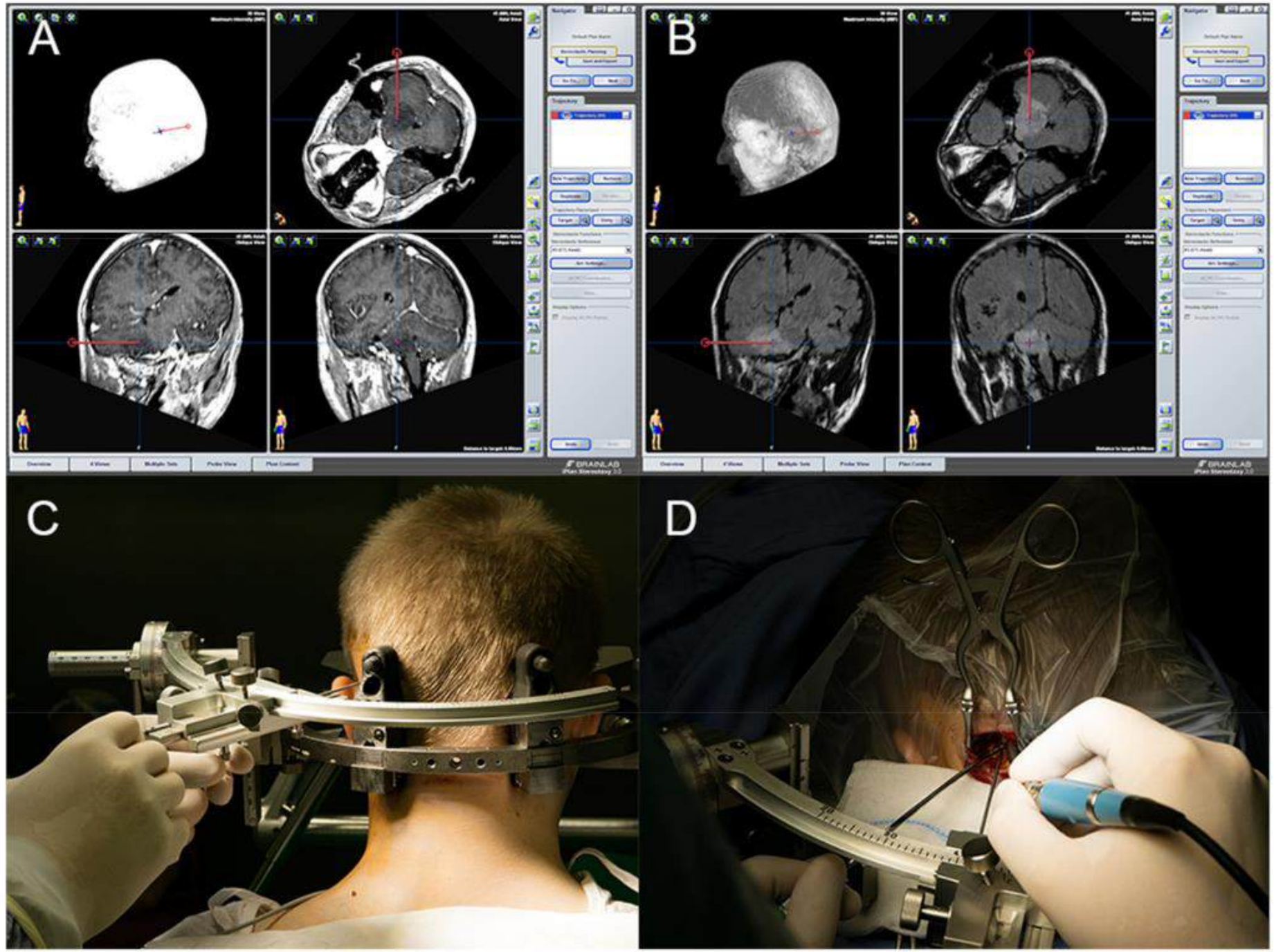
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Treatment Modalities

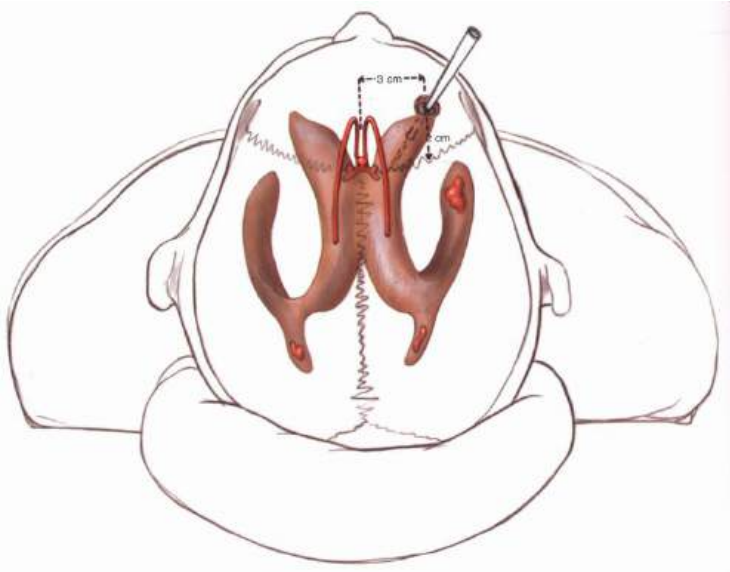
SURGICAL RESECTION

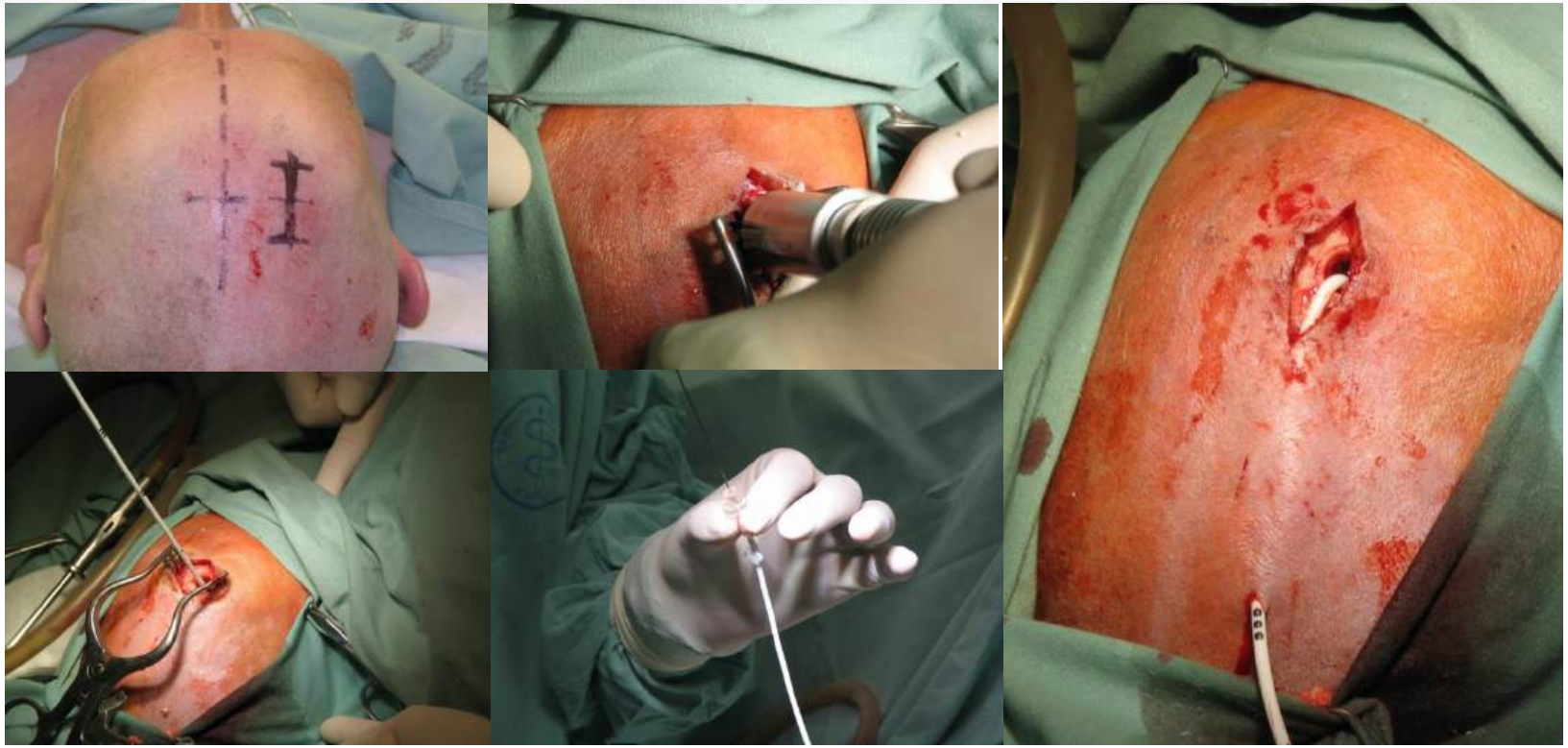
CHEMOTHERAPY

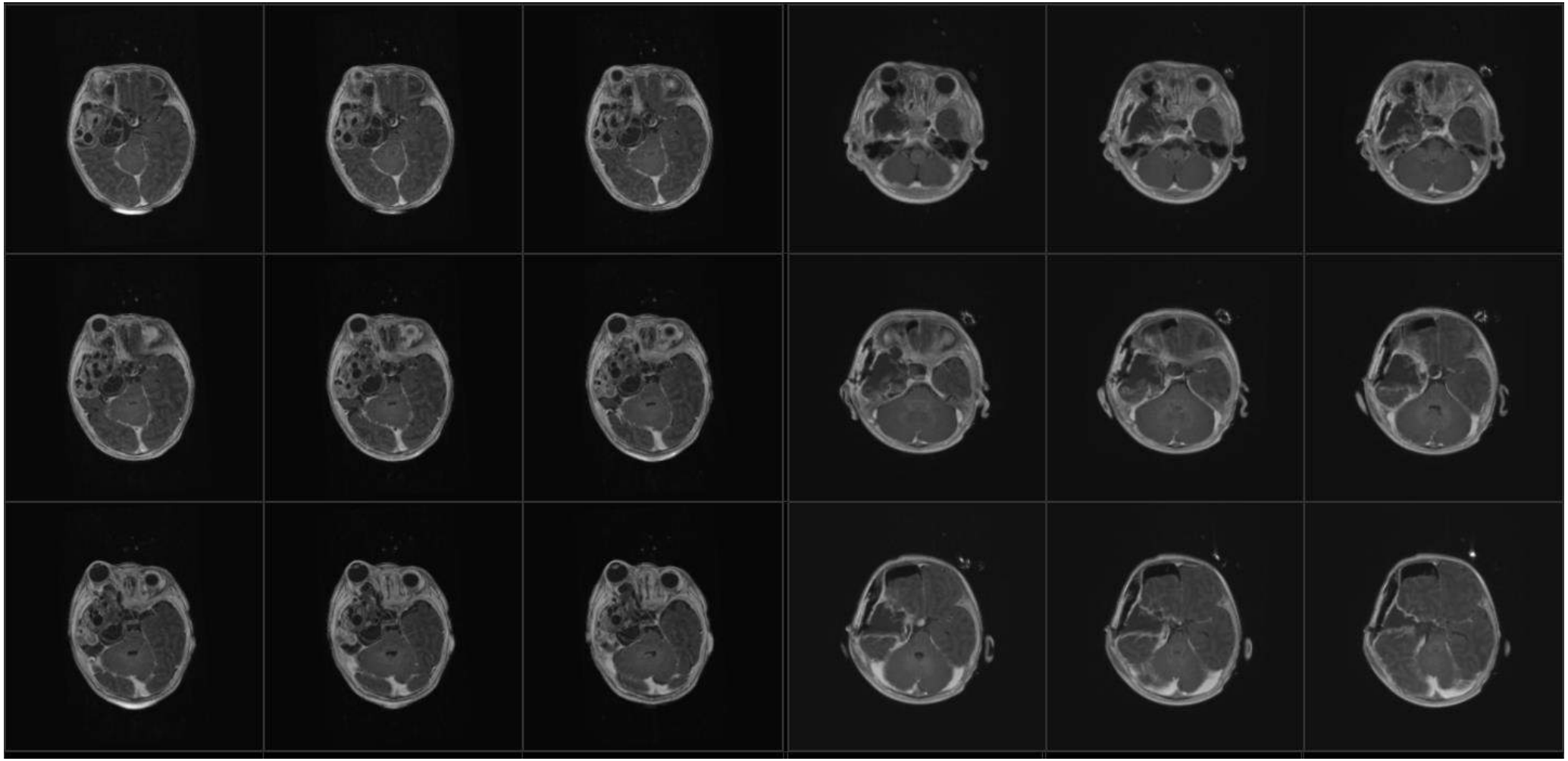
RADIATION THERAPY

TARGETED THERAPIES

Emergency procedure

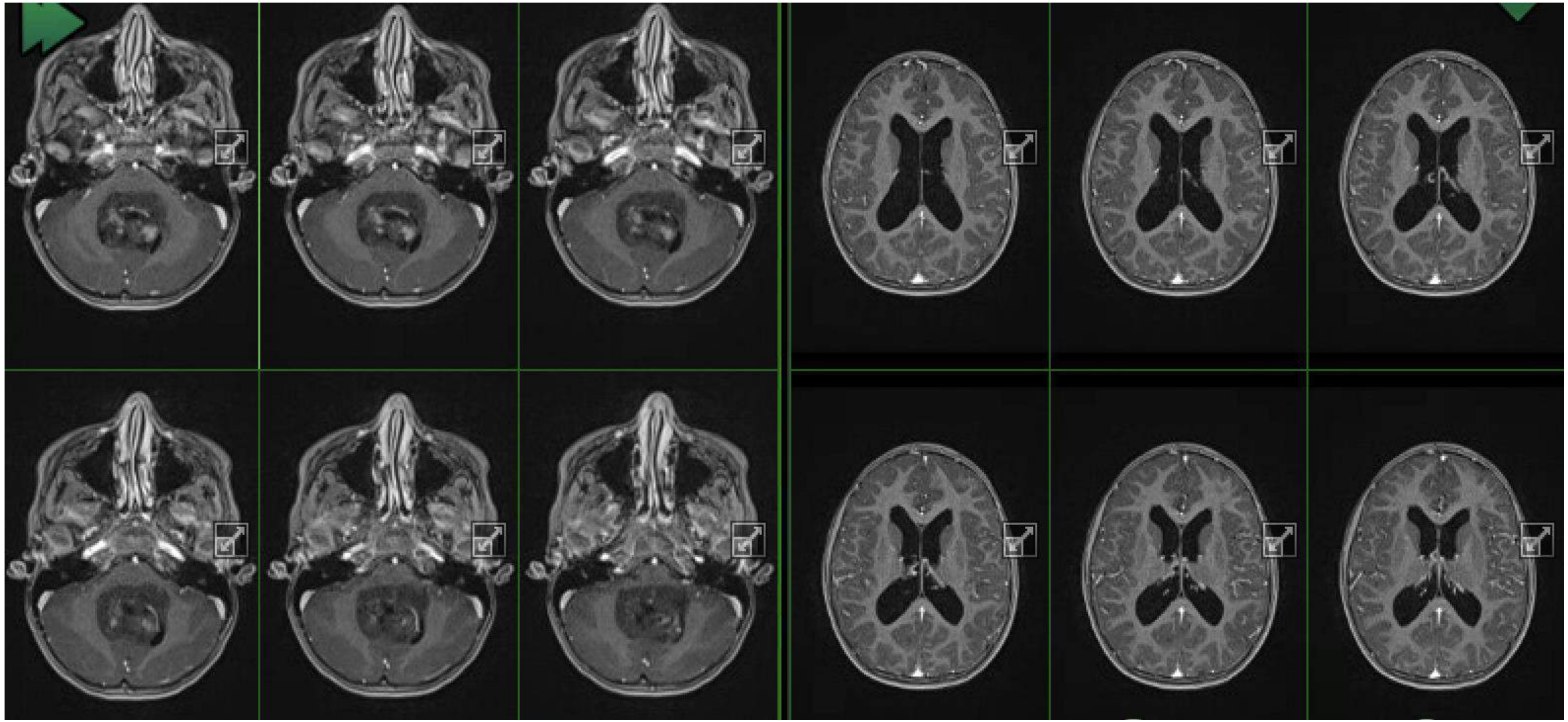


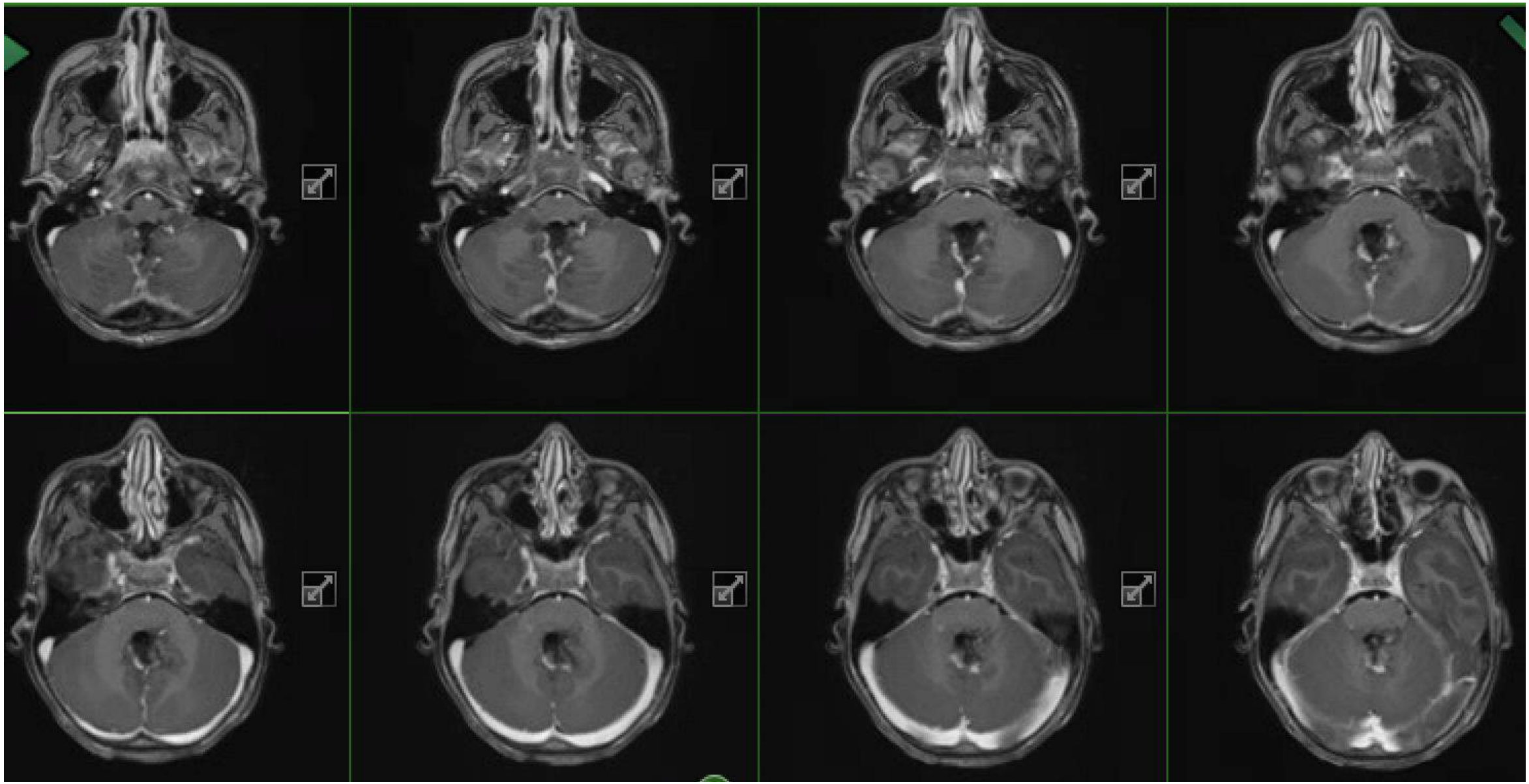


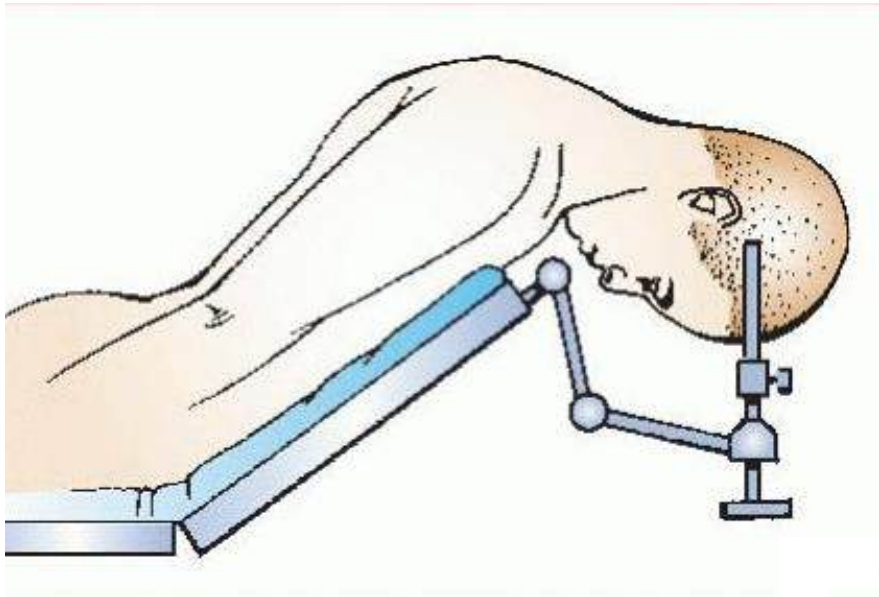


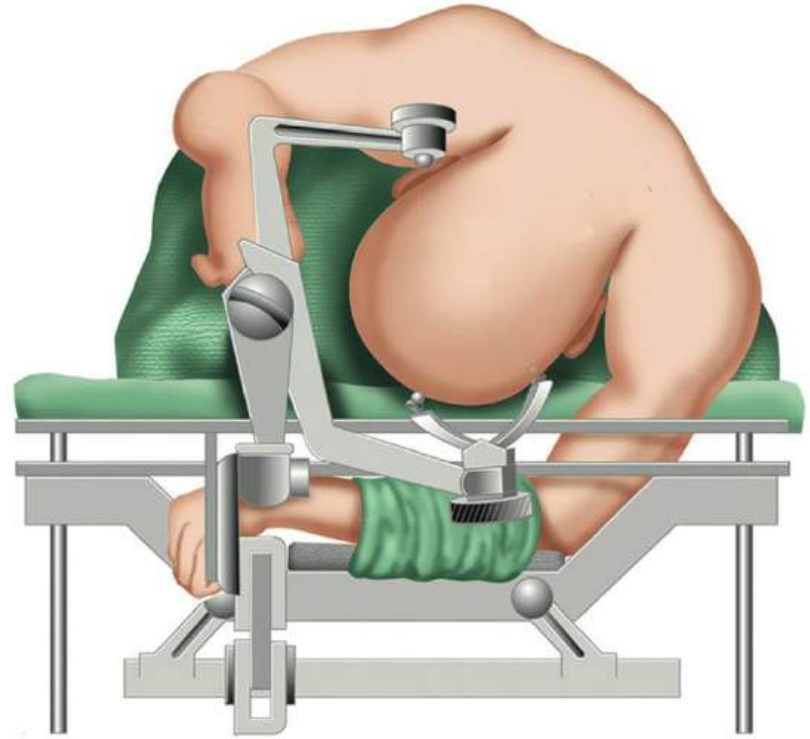
Benefits of surgical procedures

Tumor removal, histology, debulking (cytoreduction), ventriculostomy, Ommaya, VP shunts,…









Intraoperative monitoring

- SSEP
- MEP
- BAEP
- Cranial nerves

*TIVA

Treatment - Surgery

- In general, needed for diagnosis
  - exceptions: Germ Cell Tumor, Brainstem glioma
- Ideal is gross total resection

  Cave! prognosis vs. morbidity!
- Debulking, shunts, reservoirs

  - for symptom/ICP reduction, therapy

Complete resection is *critical* in…

- **Ependymomas**

Complete resection is *important* in…

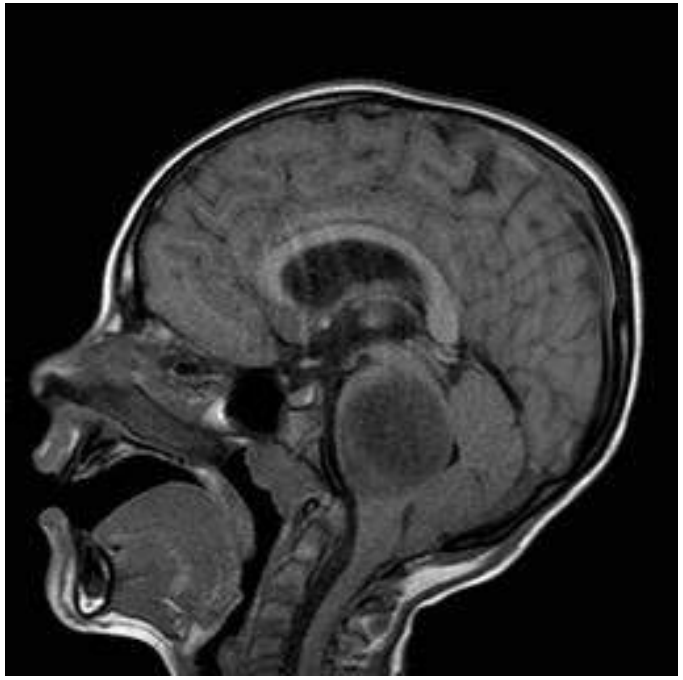
- Choroid plexus tumors
- AT/RT
- Low-grade glial tumors
- High-grade glial tumors
- Craniopharyngioma

Incomplete resection is *tolerable* in…

- Medulloblastoma
- DNET

Surgery is often wrong approach in …

- Intrinsic pontine glioma
- Optic pathway glioma
- Neurofibromatosis Type I
  - Suspected neoplasms
  - Myelin vacuolization
- Germinoma
- Non-germinomatous germ cell tumors
  - Chemotherapy initial, surgery for residual
  - (except teratoma)



Therapy - Chemotherapy

Adjunct therapy in most cases

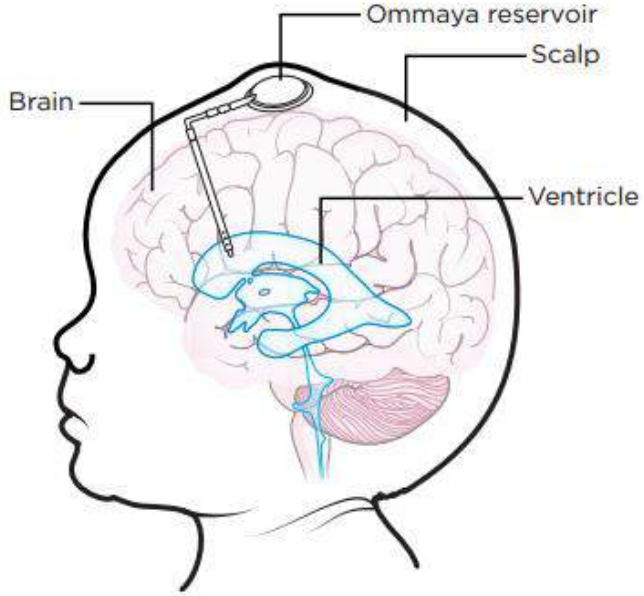
- particularly in GCT, medulloblastoma

Of interest in young children

- (avoid or prolong XRT)

Blood brain barrier *may* be limiting

- Newer studies suggest this may not be so
- Local delivery via pumps/reservoir/IT



Which tumors are chemosensitive?

- Germinoma
- NGGCT (choriocarcinoma, teratoma, yolk sac tumor)
- Medulloblastoma
- PNET
- AT/RT
- CPC
- Low-grade glioma

SENSITIVE

- High-grade glioma
- Ependymoma
- Craniopharyngioma
- DNET
- Chorioid plexus papilomas

RESISTANT

Treatment – Radiation Therapy

Potential for use in all brain tumors

- exceptions: choroid plexus tumors

Neuro-axis prophylaxis

- if tumor disseminates via CSF

Concerns for long term side effects

- neuro-cognitive
- hearing
- secondary cancers
- endocrine
- skeletal growth

The worst side effects

Second malignancies	• XRT: meningiomas & GBMs • Alykylators & etoposide: leukemias
Neurocognitive deficits	
High-frequency hearing loss	• Platinums
Difficulty with fertility	• alkylators

Complications

- Neurological deficits
  - limb paresis
    - Rehab/PT/OT, support
  - swallowing/speech dysfunction
    - ENT, Speech therapy
    - Nutrition issues
  - neuro-cognitive deficits
    - School/education issues + Social interaction issues
  - endocrine dysfunction
  - end-organ damage
    - kidney, liver, hearing, neuropathy

Strategies in recurrence

- High-dose chemo with stem cell rescue
- Experimental clinical trials
  - Small molecule inhibitors
  - OHSU: IA/BBBD
- Anti-angiogenic regimens
- Palliative care

Thank you for your attention