Imaging of brain tumors

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Issues in radiologic-pathologic correlation

- Complex relationship between enhancement and tumour grade
- Most malignant tumours enhance
- Yet, some of the most benign tumours also enhance
- Constellation of imaging and demographic findings seen in low grade enhancing tumours

ROLE OF RADIOLOGIST

- Most likely diagnosis = histopath
- Look for extent and spread
- Part of multidisciplinary team

GOALS OF IMAGING

Pre Therapy

- **Extent of the tumour**
- **Differential diagnosis**
- **Detect complications**
- **Grading of lesion**
  - **enhancement**
  - **mass effect**
  - **necrosis/bleed**
  - **cyst formation**
  - **definition**

Post therapy

- **Residual tumour**
- **Recurrent tumour**
- **Radiation effects**

ROLE OF CT SCAN

- Initial investigation in non-specific complaints
- Differentiation between calcification and hemorrhage
- Status of adjoining bones / primary bone lesion
- Immediate post-operative status
- Multiple follow ups

ROLE OF CT SCAN

Role of MRI in evaluation of brain tumors

- Delineate size and extent of the tumor :
- Define the relationship of tumor to adjacent anatomical structures.
- Characterization of the tumors.
- Functional MRI-in pre operative planning.
- MRS-vital tool in differentiating malignant from non malignant entities.

TUMOR PROTOCOL

- Axial T1, T2
- Axial FLAIR
- Axial Gradient
- Coronal T2 / SOS Sagittal T2
- Diffusion
- Perfusion followed by post-contrast – all 3 planes
- Spectroscopy
- DTI +/-

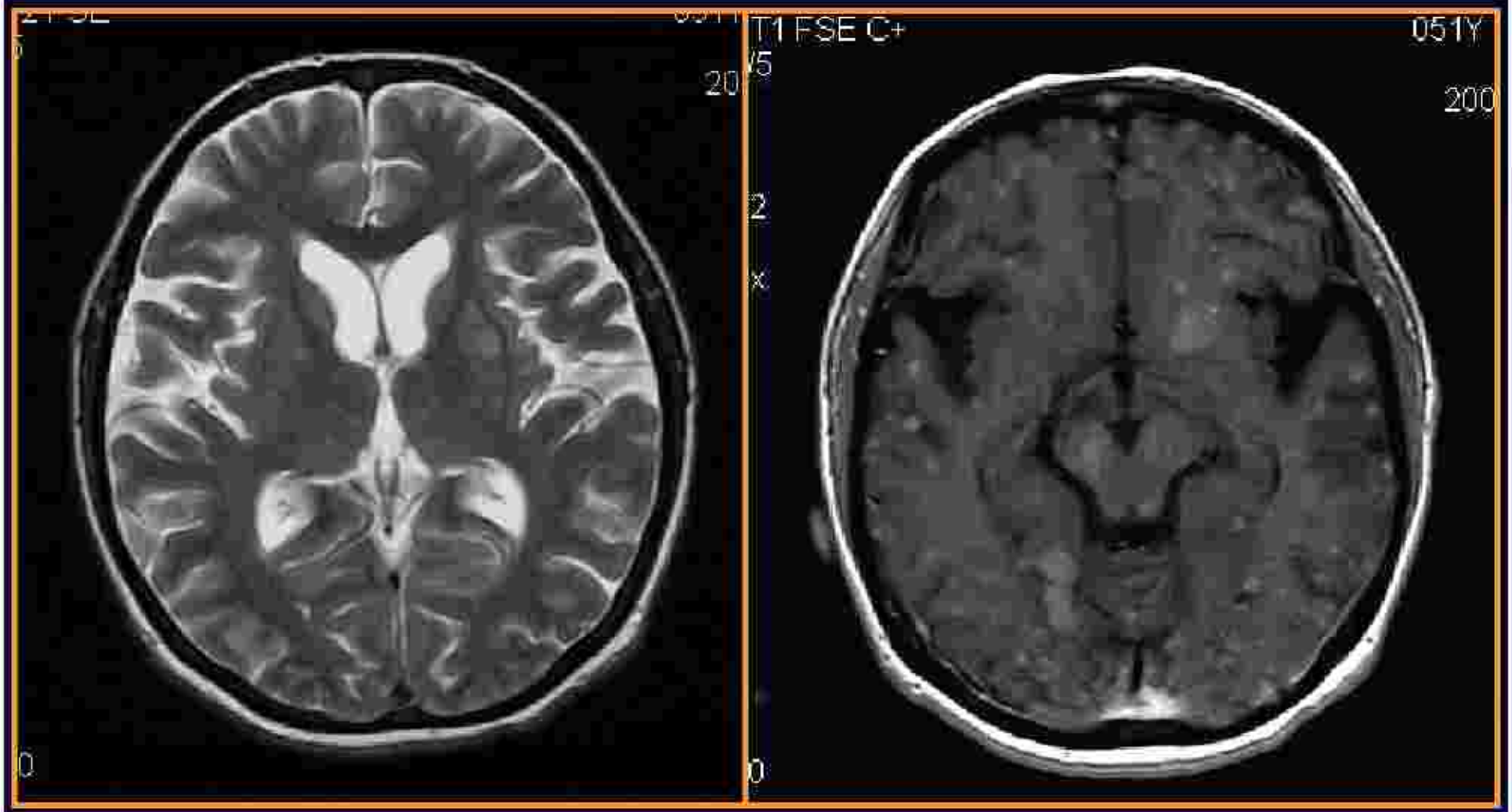
Role of MRI contrast

- Better delineation and characterization of tumors
- Better visualization of mets isointense on non enhanced scans
- Estimating tumor grade
- Leptomeningeal involvement
- MR spectroscopy

contrast

- Contrast cannot always differentiate b/n tumor & edema
- Lack of enhancement does not signify lack of tumor

Is contrast necessary ?



Look for…. …. ….

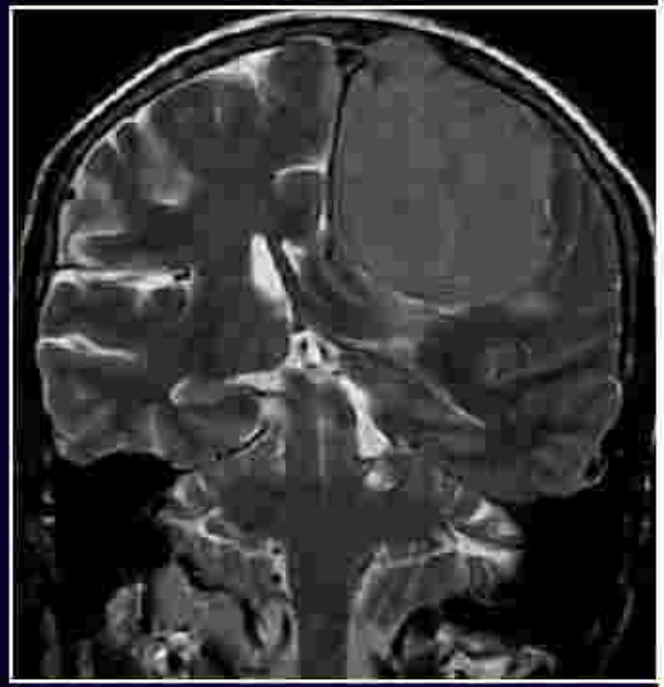
- Age of patient
- Site of tumor - Posterior fossa is a rare site for primary malignancy in adults
- Supratentorial,post fossa, sellar, pineal, intraventricular

Look for…….

- Intra vs extra axial
- Neoplastic vs non neoplastic
- Pathologic type
- Benign vs malignant
- Primary vs metastatic
- Grade of malignancy
- Mechanical effect

Intra vs extra axial

- Definitive – CSF cleft
- Bone involvement
- Relation to dura / invasion /
- Meningeal enhancement
- Buckling of cortex
- Vessels

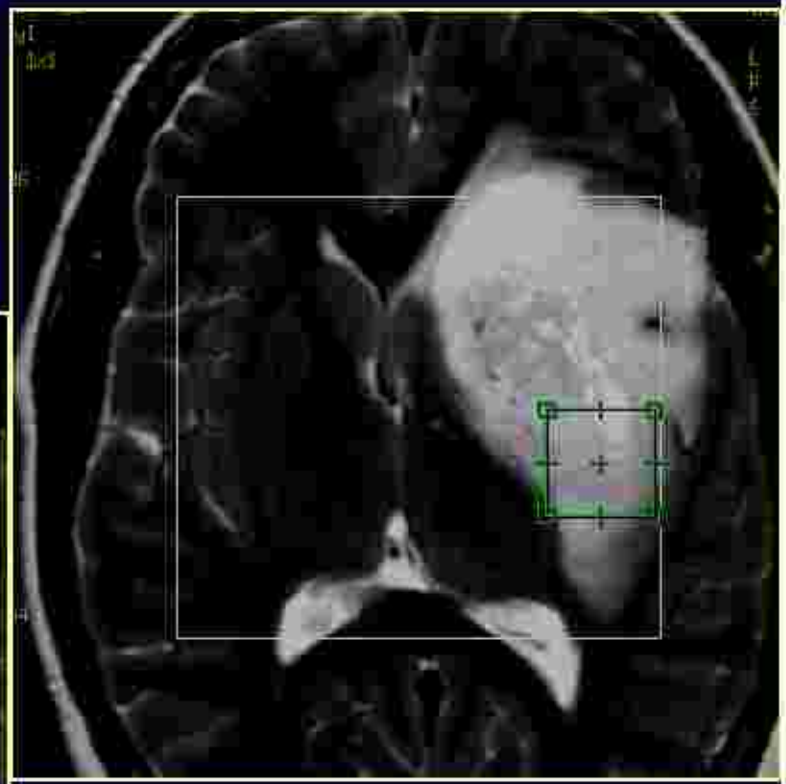


Infiltrative vs localised / well marginated

- Margin
- Edema
- Homogeneity
- Relationship to adjoining structures

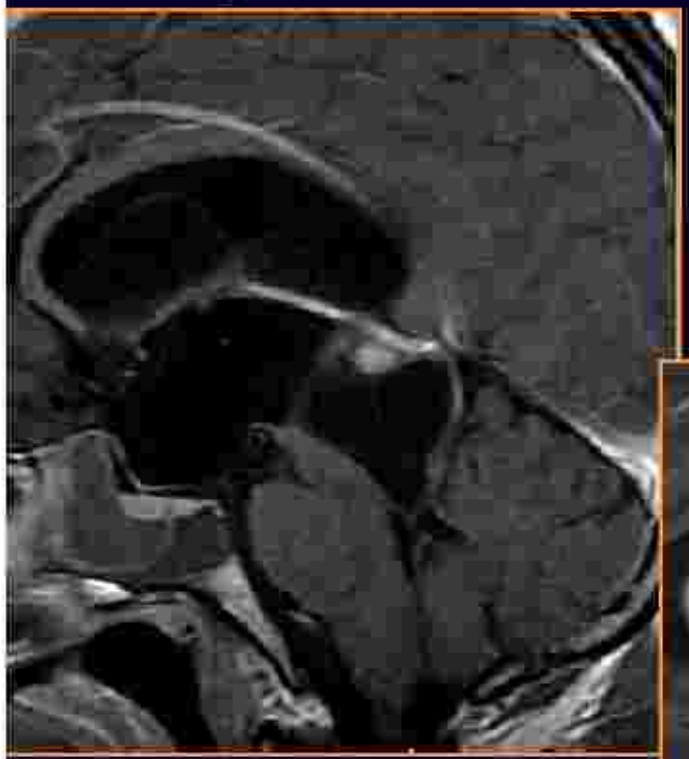
What is the consistency?

- Solid / firm
- Soft / early necrosis



Where is the epicentre?

- Helps to determine origin



Is there necrosis?
Is there hemorrhage?

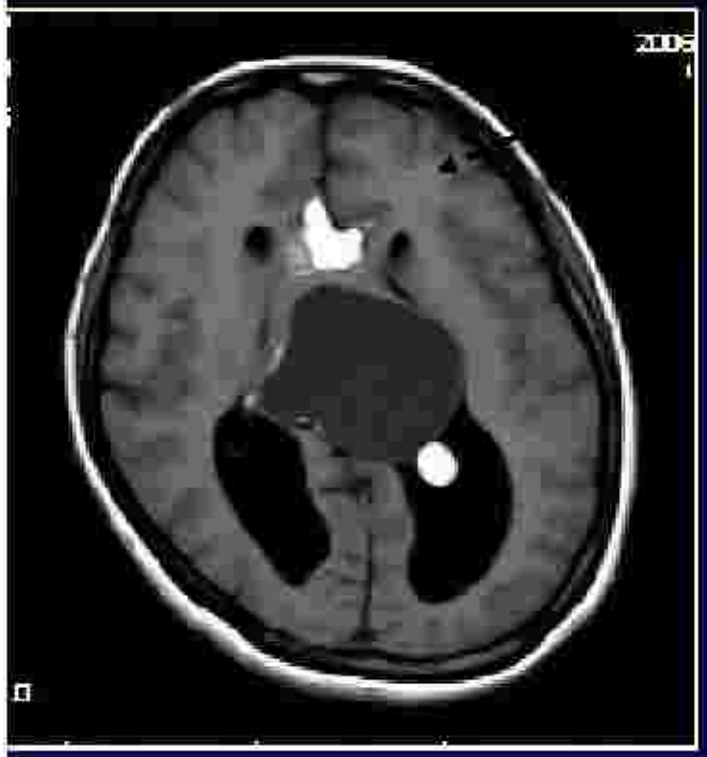
Is there haemorrhage ?

- Primary – GBM, anaplastic oligodendroglioma,ependymoma
- Metastases – melanoma,RCC,chorioca, breast ca, lung ca, thyroid ca

Is there a cyst ?

- Fluid debris levels

Fat- Ruptured dermoid



hypervascularity

PEDIATRIC IMAGING
Special Issues

- Sedation
- Spinal Imaging = Longer scan time
- Movement inspite of sedation
- Normal variants and appearances

POSTERIOR FOSSA TUMORS

- Midline
- Hemispheric
- Brain stem
- Exophytic

POSTERIOR FOSSA TUMORS- symptoms

- Midline - Raised ICT – vomitting headache
- Hemispheric – Cerebellar signs
- Brain stem – Cranial nerve palsies
- Exophytic – Cranial nerve palsies

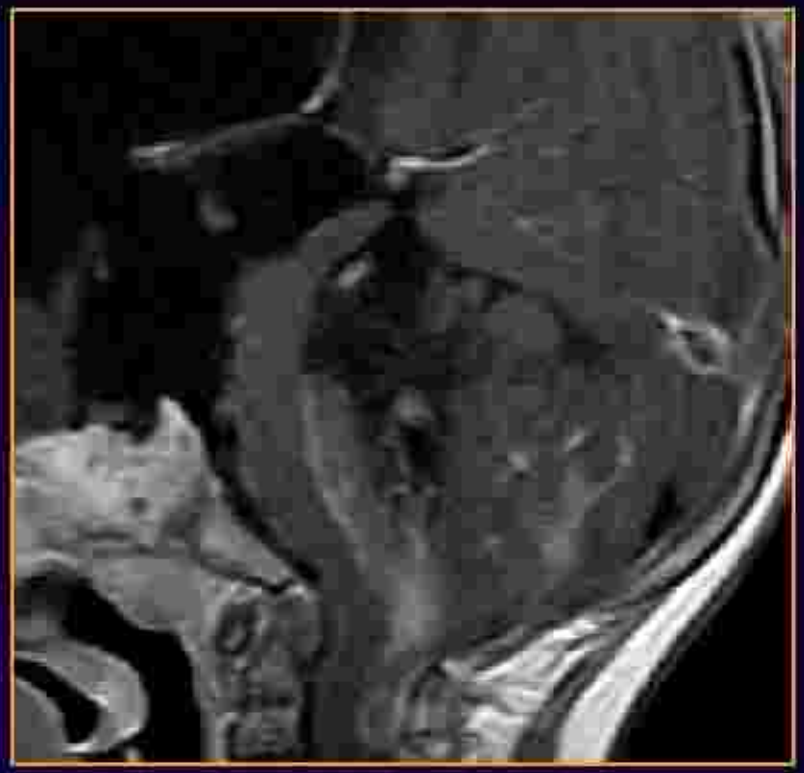
Medulloblastoma

- Vermian location. Occasionally cerebellar hemispheric
- Well circumsribed, spherical
- Hemorr, cysts, Ca+ uncommon
- High nuclear-cytoplasmic ratio

Laterally placed / Cyst formation

Lack of significant enhancement

EPENDYMOMA



EPENDYMOMA

PILOCYTIC ASTROCYTOMA

Brain Stem Gliomas

- Fibrillary and pilocytic

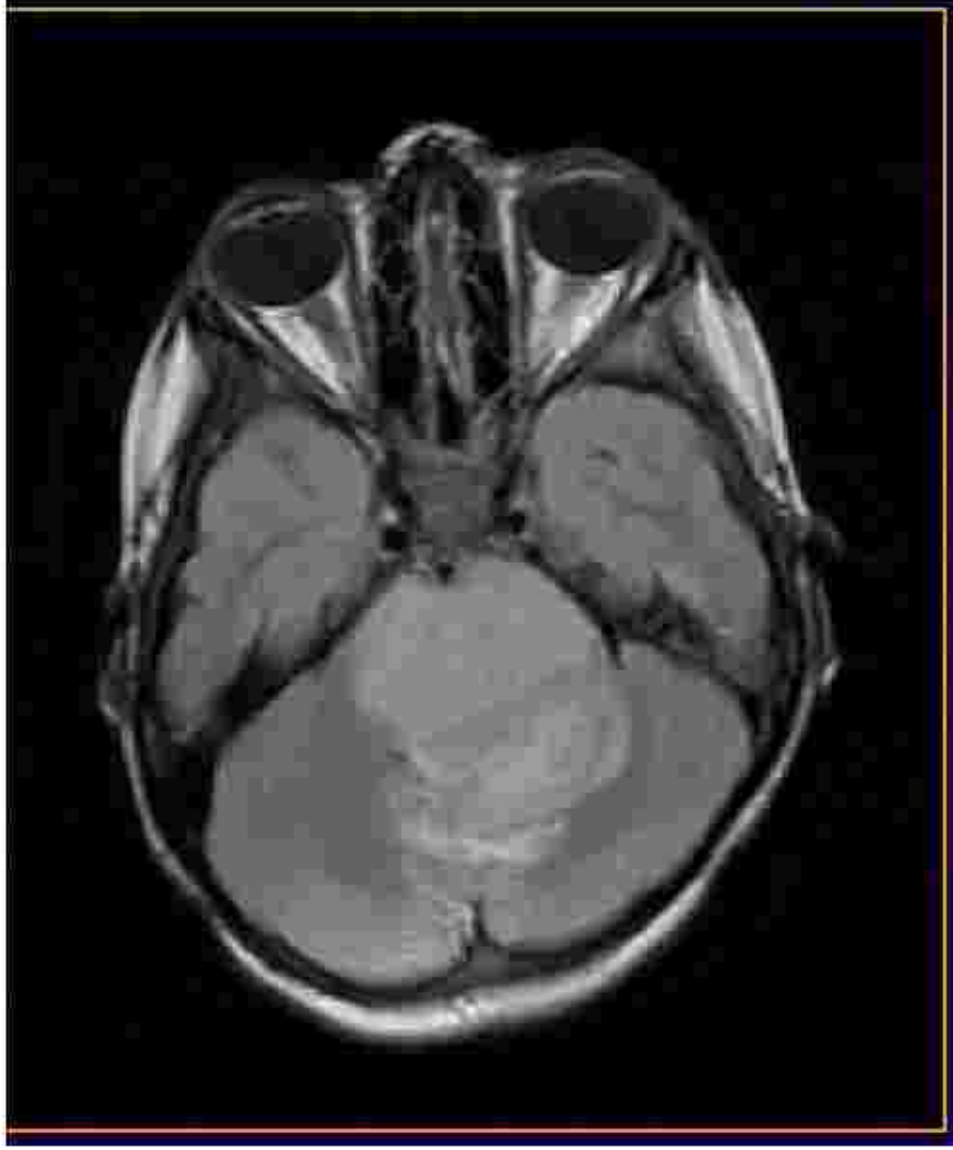
  Medullary

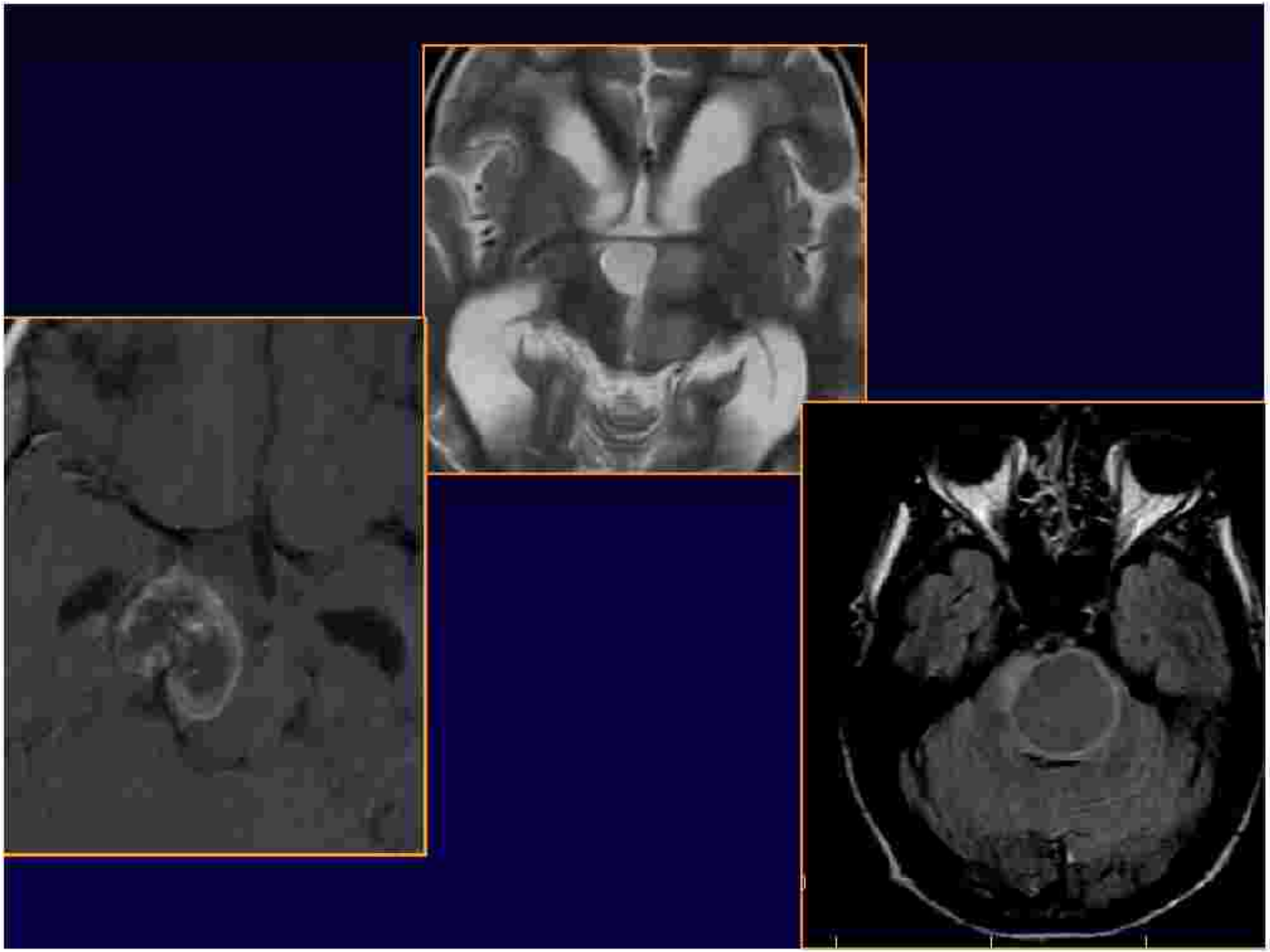
  Pontine

  Mesencephalic

  Focal Diffuse

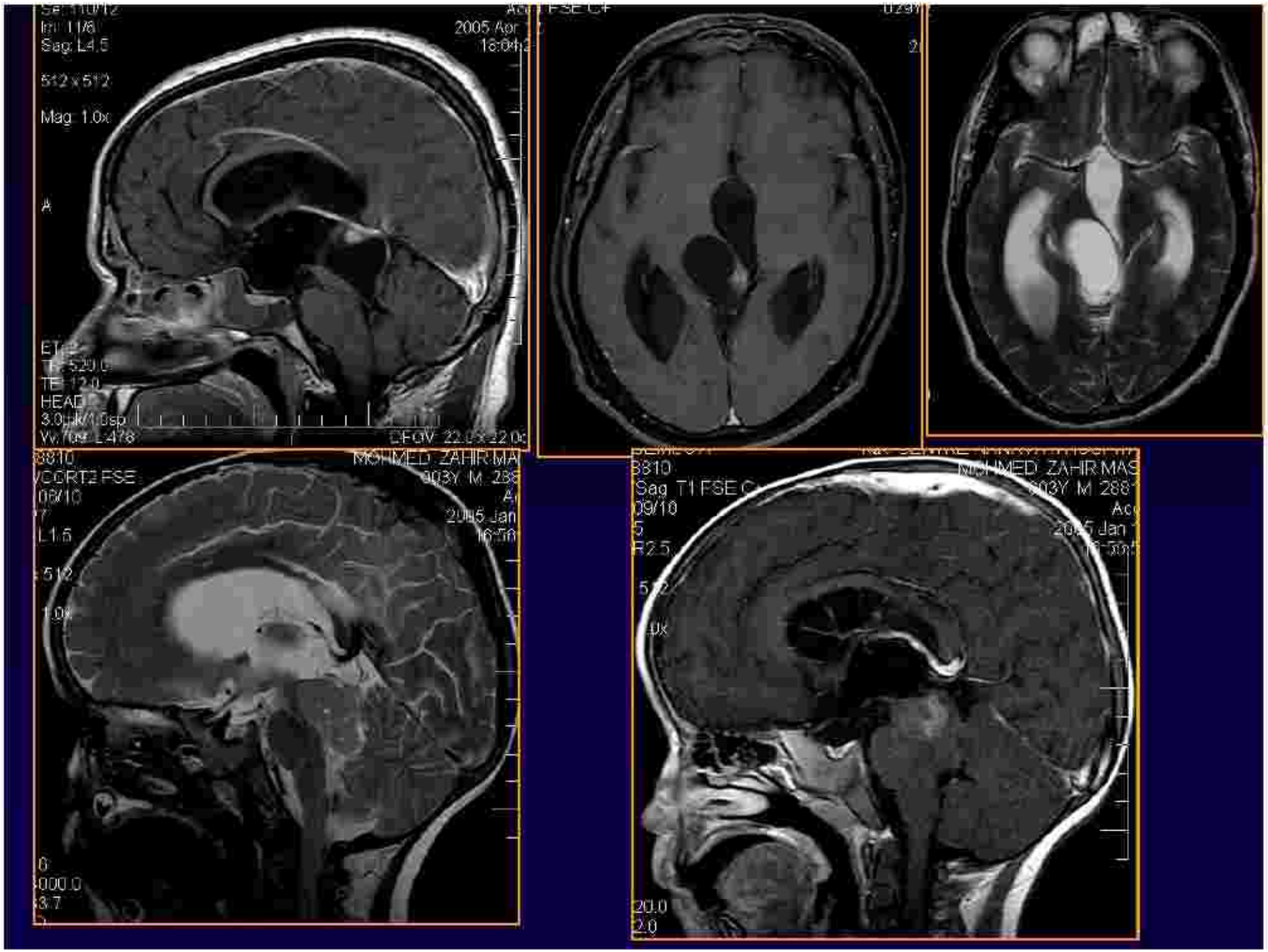
Diffuse pontine with exophytic component





Tectal Plate Glioma

- Small lesions
- Hydrocephalus


2005 Apr
Mag 1.0x
HEAD
MOHMED ZAHIR MA
2005 Jan
Sag T1 FSE C
MOHMED ZAHIR MAS

SUPRATENTORIAL TUMORS

- Supratentorial
  - Cortical
  - In relation to ventricles
  - Intraventtricular
  - Deep parenchymal

SUPRATENTORIAL TUMORS

Supratentorial

- Cortical - seizures
- In relation to ventricles – Raised ICT
- Intraventricular – SGCA, CPP, Epen
- Deep parenchymal – Neurological deficits

SUPRATENTORIAL TUMORS

Supratentorial

- Cortical Solid- DNET, low grade astroc
- Cortical Cystic – Pilocytic, Ganglioglioma, PXA
- In relation to ventricles - ependymoma
- Intraventricular – SGCA, CPP, Epen
- Deep parenchymal - PNET

SUPRATENTORIAL TUMORS

Midline

Pineal Region- Raised ICT, neurological deficit

Suprasellar – Visual / Endocrine symtoms

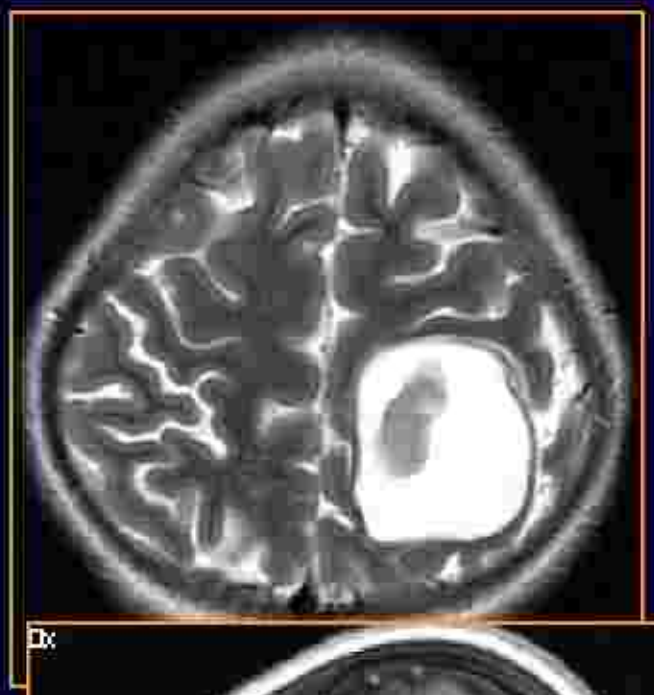
SUPRATENTORIAL TUMORS

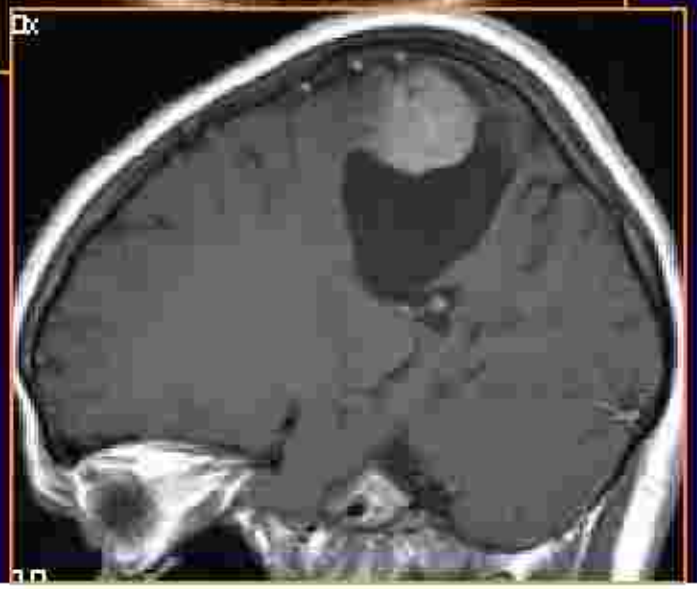
Midline

Pineal Region- PNET, Germ cell tumor

Suprasellar – Visual pathway glioma,
Craniopharyngioma,
Germ cell tumor

PILOCYTIC ASTROCYTOMA

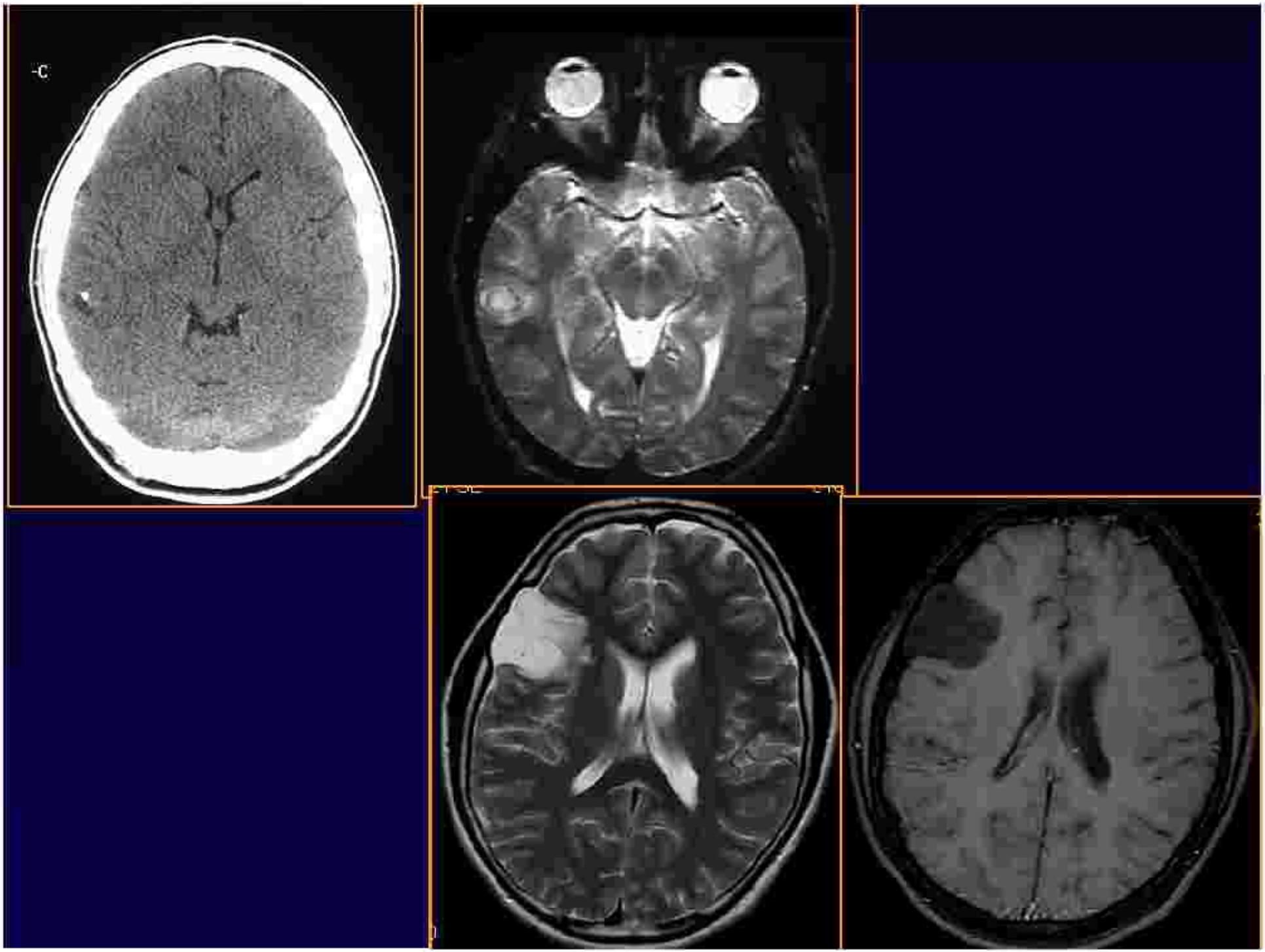




GANGLIOGLIOMA / CYTOMA

DNET

- Partial seizures.
- Associated cortical dysplasia.
- DNET can have calcification and contrast enhancement.
- Intracortical lesion located in temporal lobe
- calcification 20%
- MR: hyperintense on T2W, well demarcated and lack of peritumoral edema.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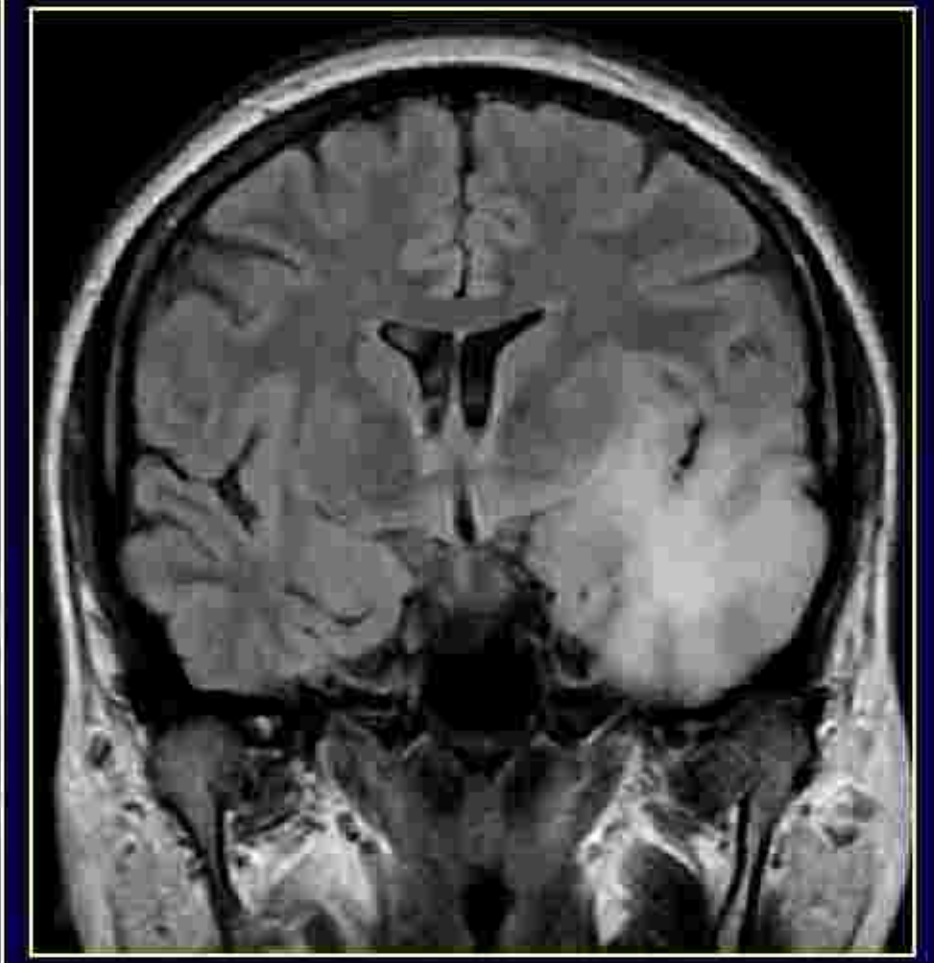
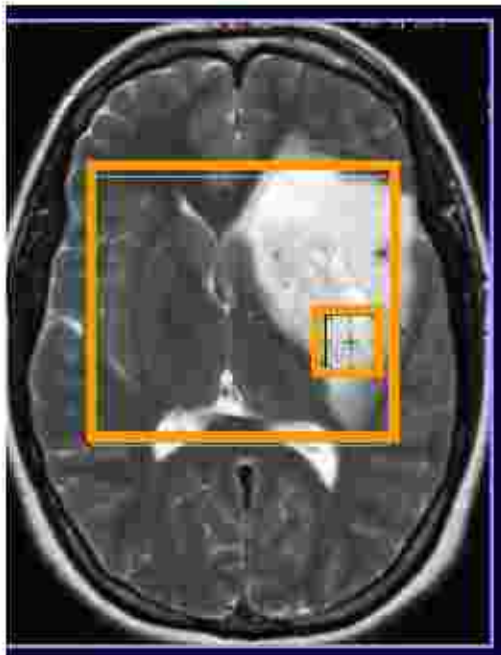
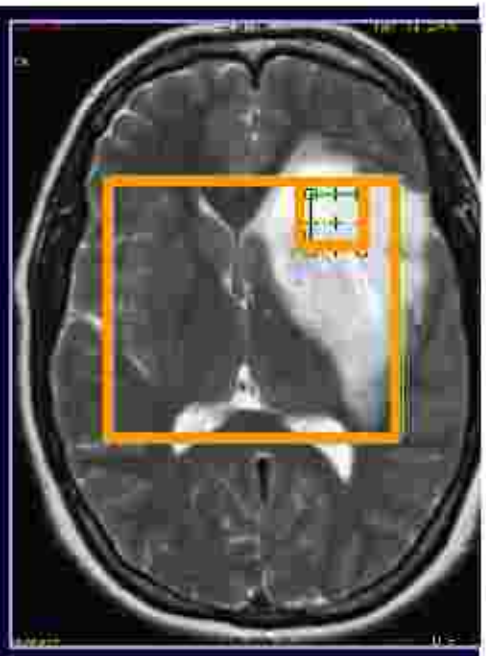
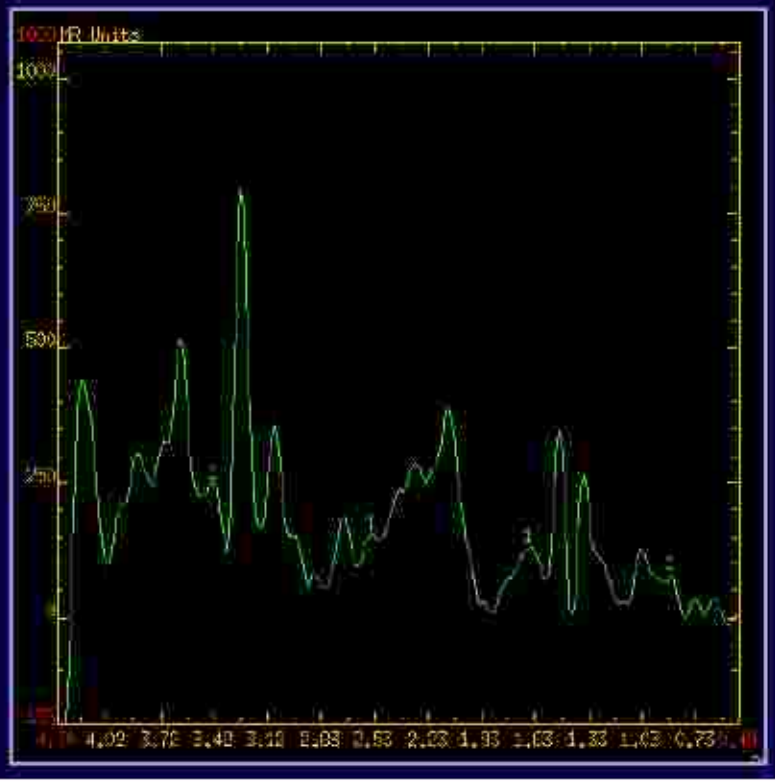
LOW GRADE GLIOMA

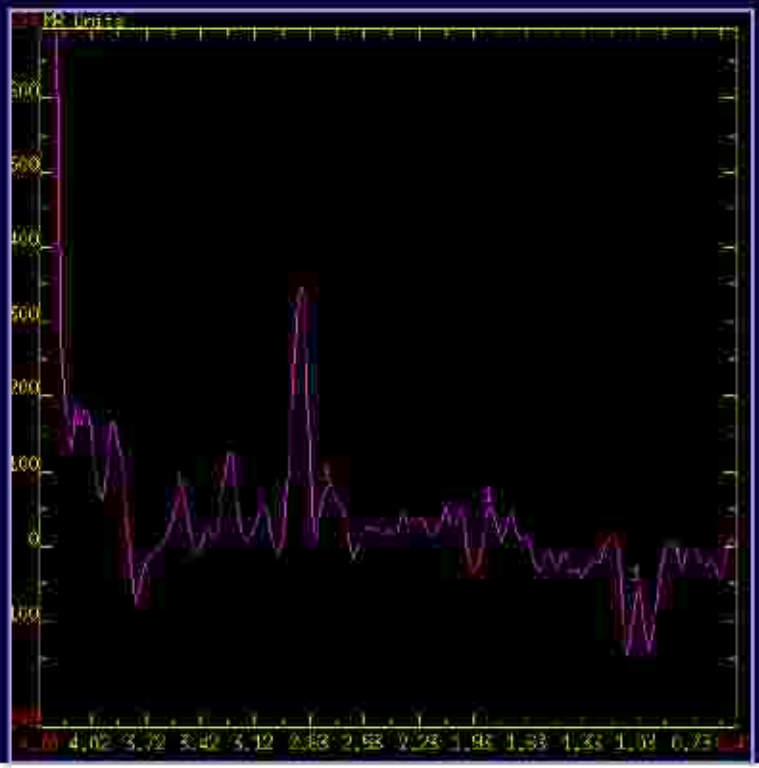


INTERMEDIATE GRADE GLIOMA

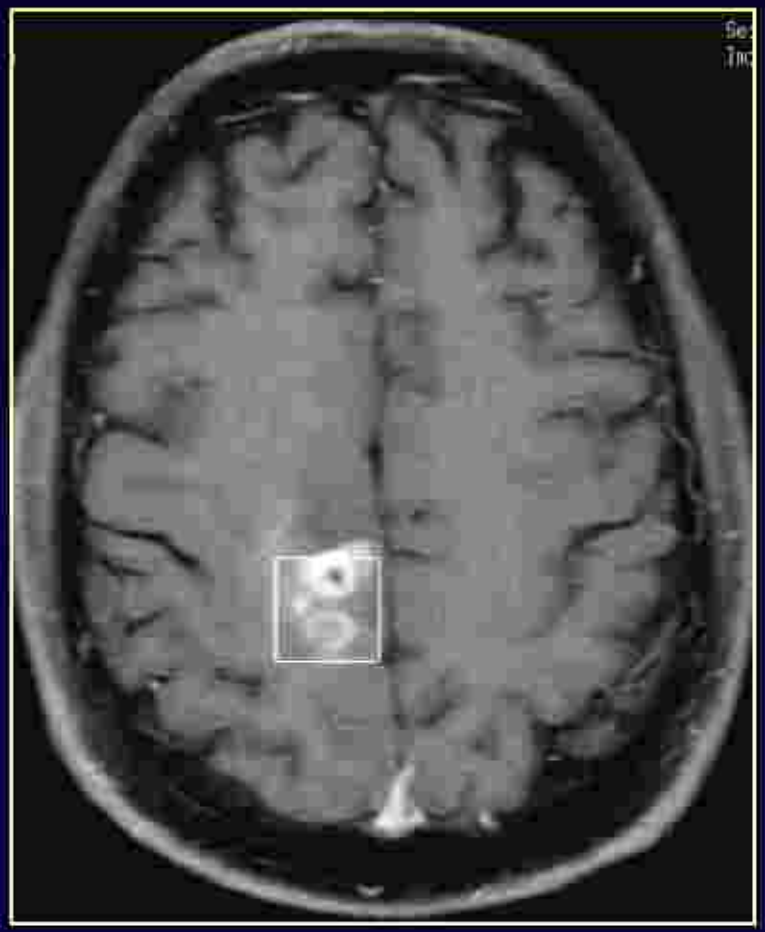




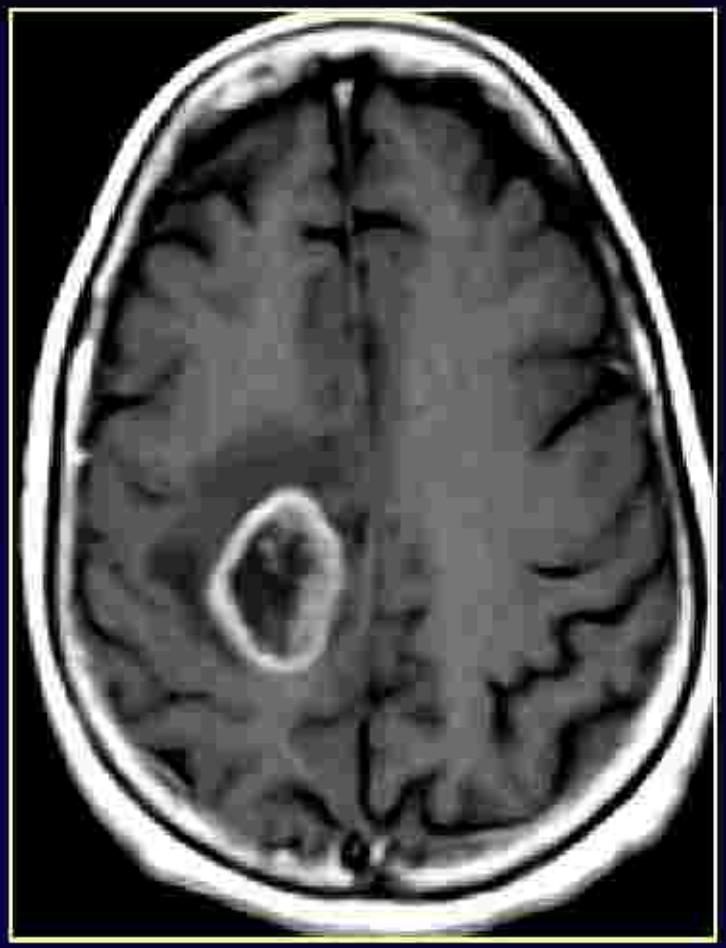




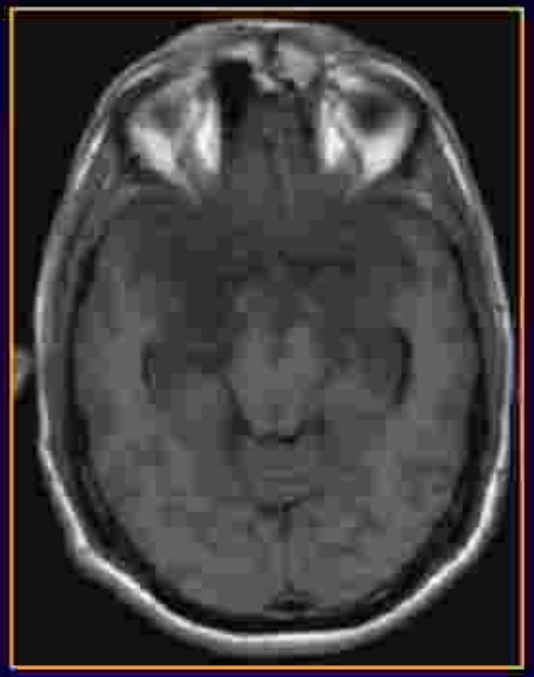
HIGH GRADE GLIOMA



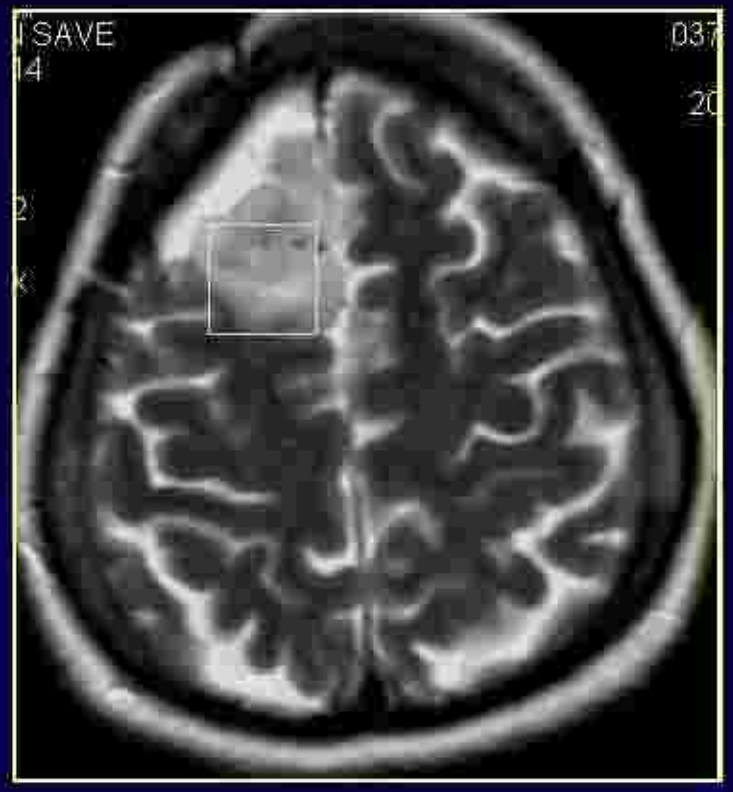
GLIOBLASTOMA MULTIFORME



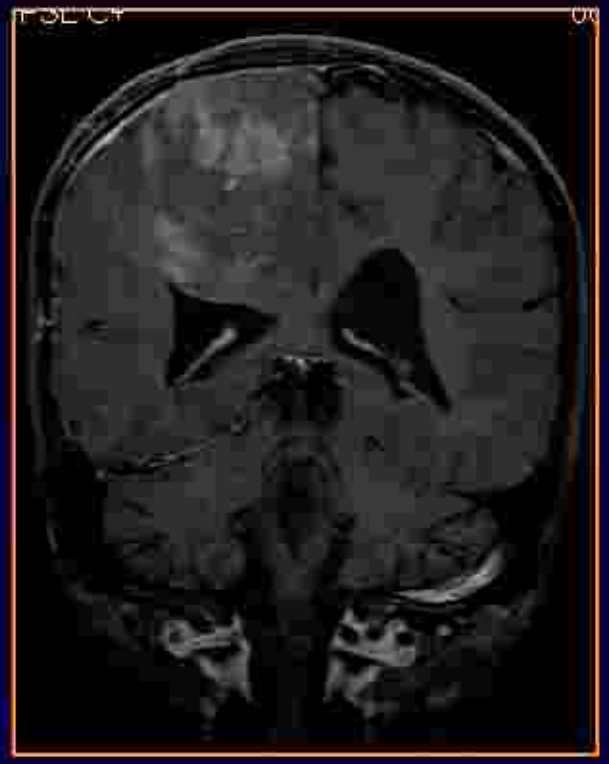
GLIOMATOSIS CEREBRI



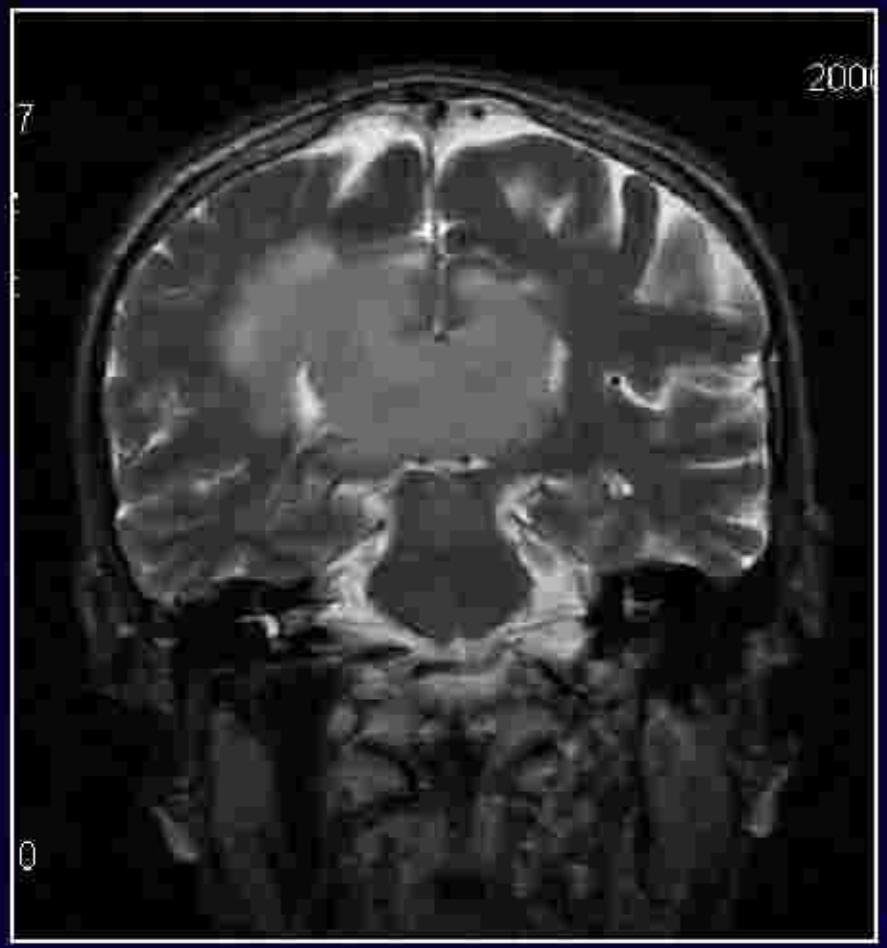
OLIGODENDROGLIOMA

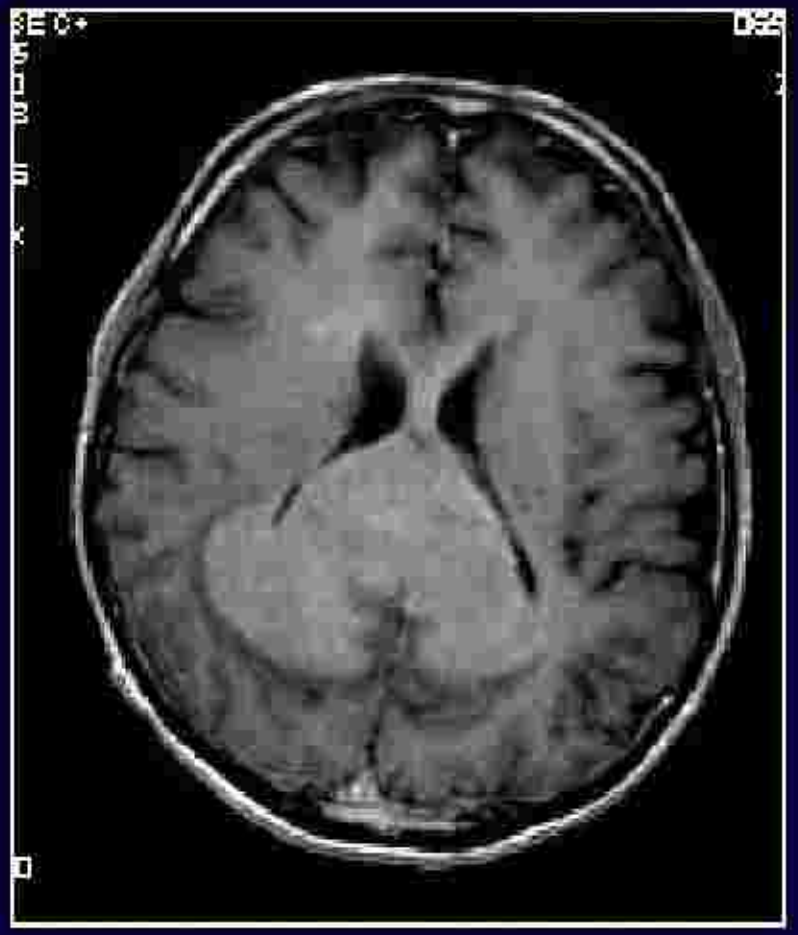


SUPRATENTORIAL PNET



LYMPHOMA



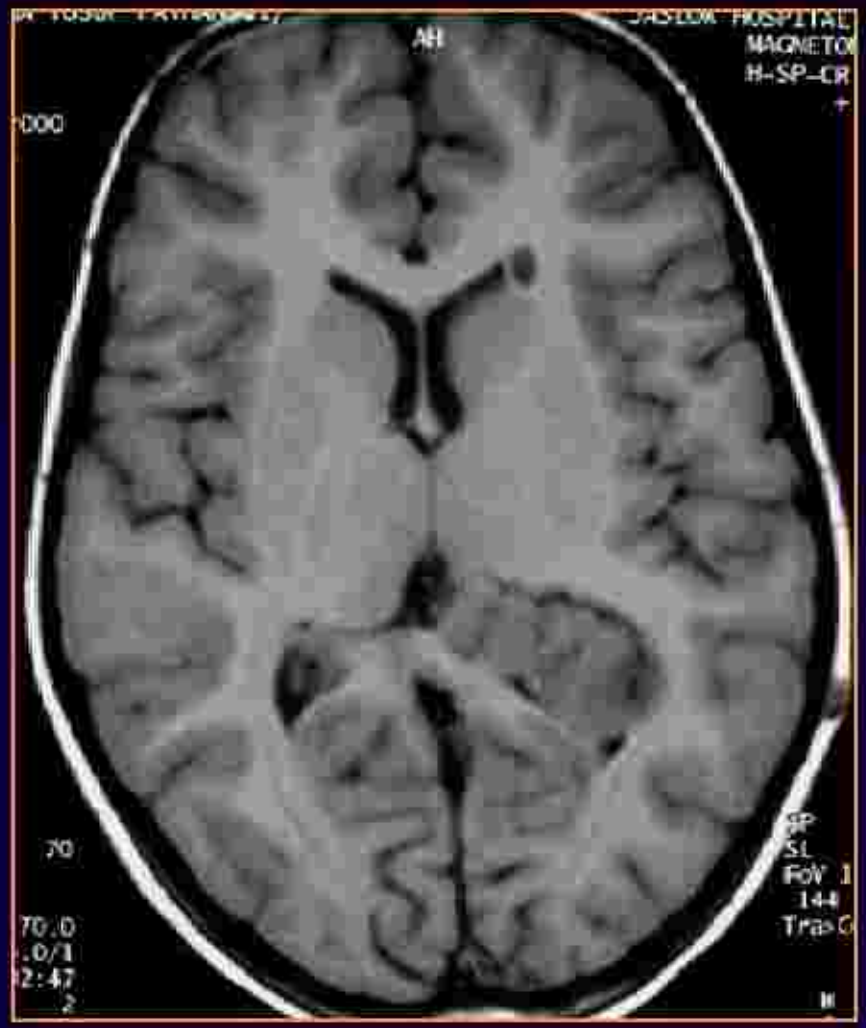


MENINGIOMA

- Sharp tumor-brain interface
- Spherical / en plaque
- Dural attachment
- Necrosis, hemorr, CENTRAL SCAR

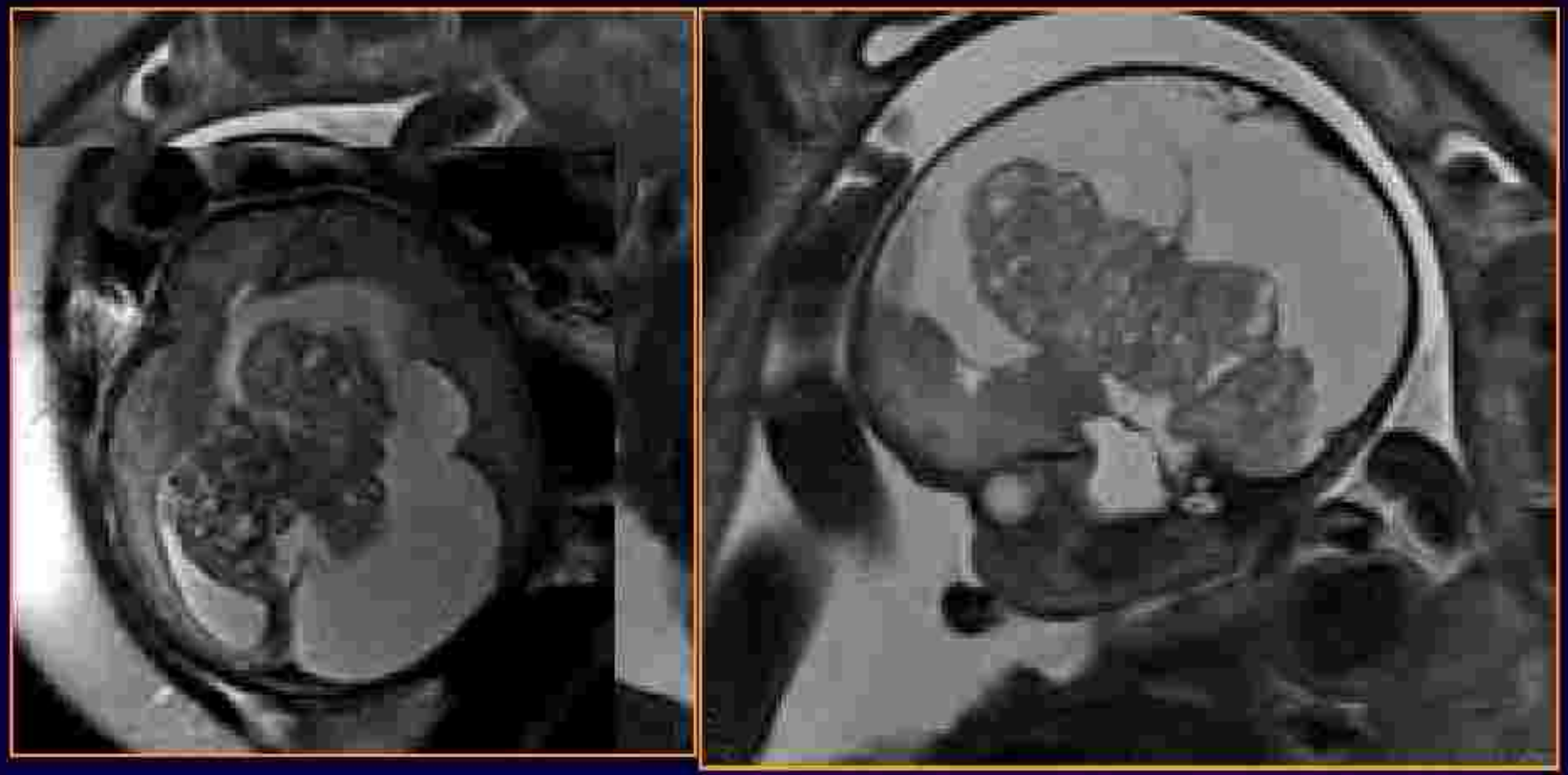
SUPRATENTORIAL INTRAVENTRICULAR

SUPRATENTORIAL EPENDYMOMA

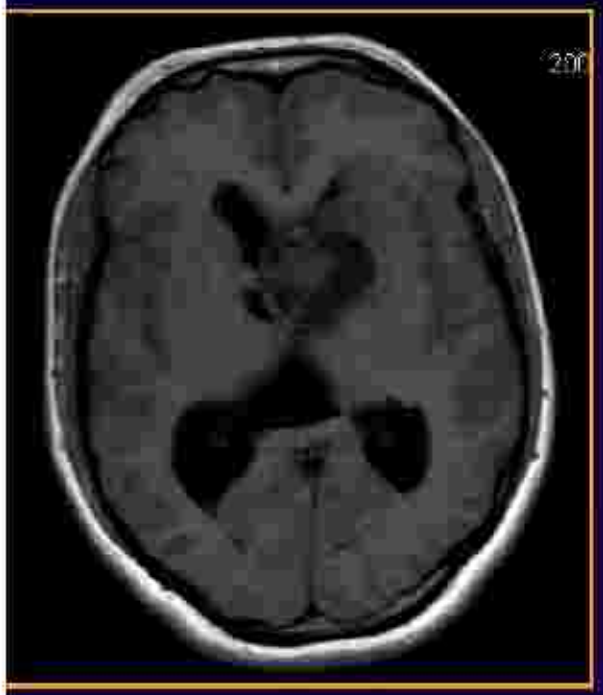


CENTRAL NEUROCYTOMA

CHOROID PLEXUS PAPILLOMA



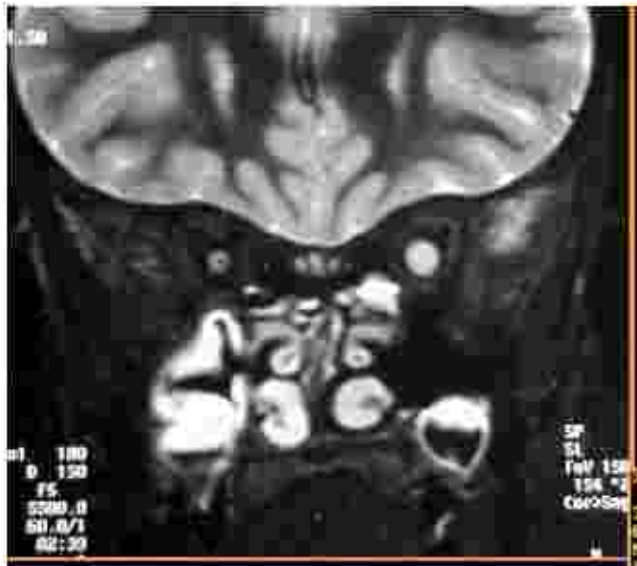
GIANT CELL ASTROCYTOMA



Intraventricular astrocytoma

SUPRATENTORIAL MIDLINE

OPTICOCHIASMATIC GLIOMA



HYPOTHALAMIC GLIOMA

CHORDOID GLIOMA

Pituitary tumors

Craniopharyngioma

50% of cases occur in first and second decade

a) Hypothalamic – 75%

b) Supra and intrasellar – 25%

c) Only intrasellar – 4%

Pre fixed or post fixed

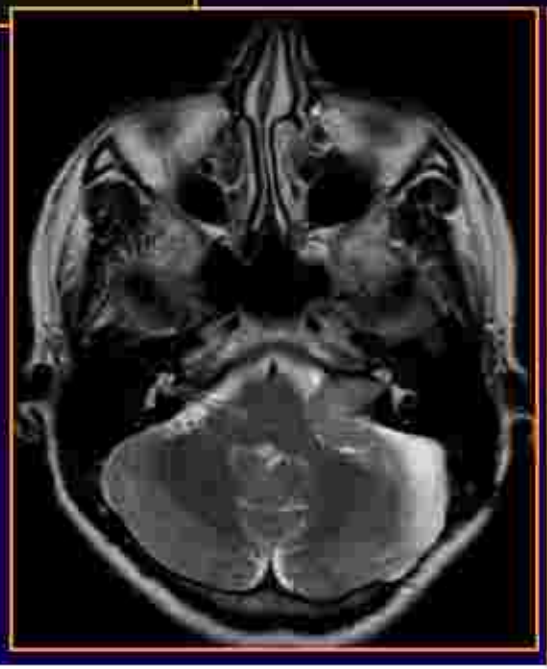
CRANIOPARYNGIOMA

Pineal Region

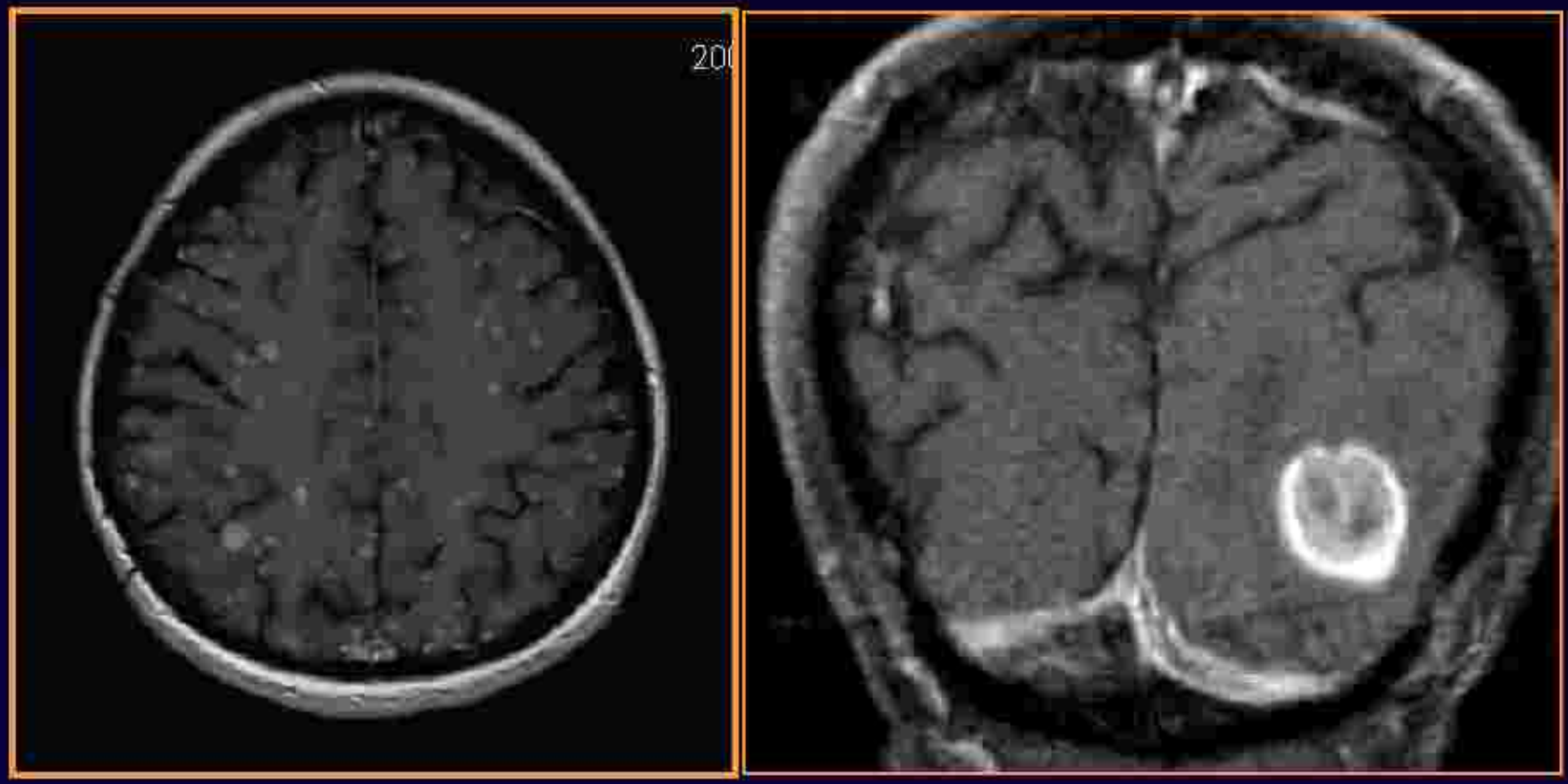
- Pineoblastoma
- Pineocytoma
- Germ cell tumor.

Pineal Tumor

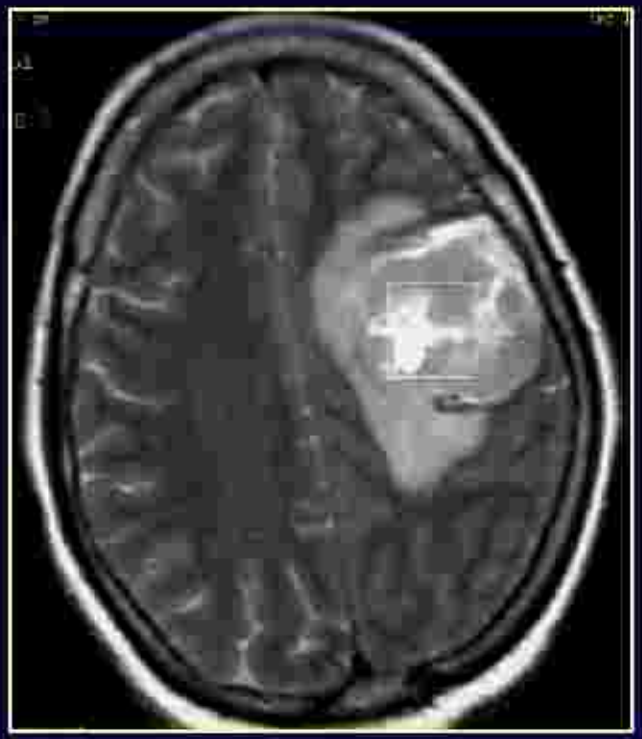
OTHERS

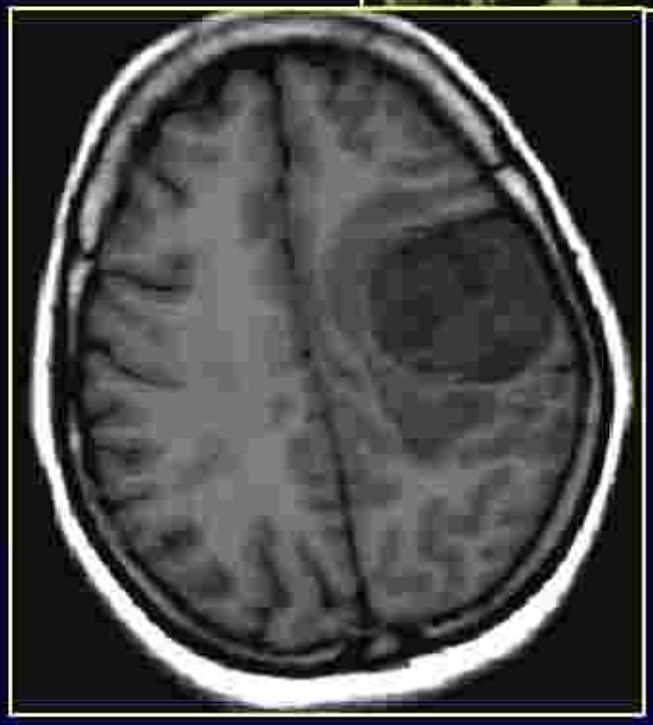


METASTASES



METASTASES





SKULL BASE LESIONS

- Chordoma
- Other bone tumors

Post treatment evaluation

- Detailed history – type of Rx ?
- What symptoms prior to Rx ?
- How much was the response to Rx ?
- Current symptoms ? Persistent or new ?
- Time since start and completion of Rx ?

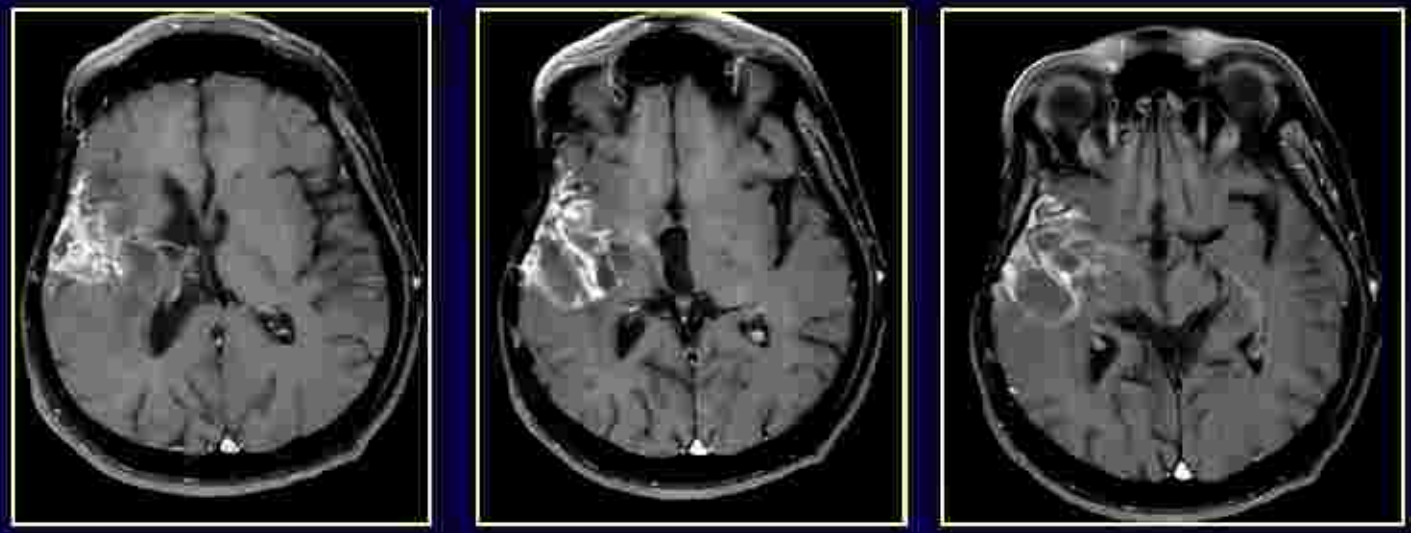
POST - SURGERY

Within 48 hrs –
before post –op changes manifest

Goal of imaging

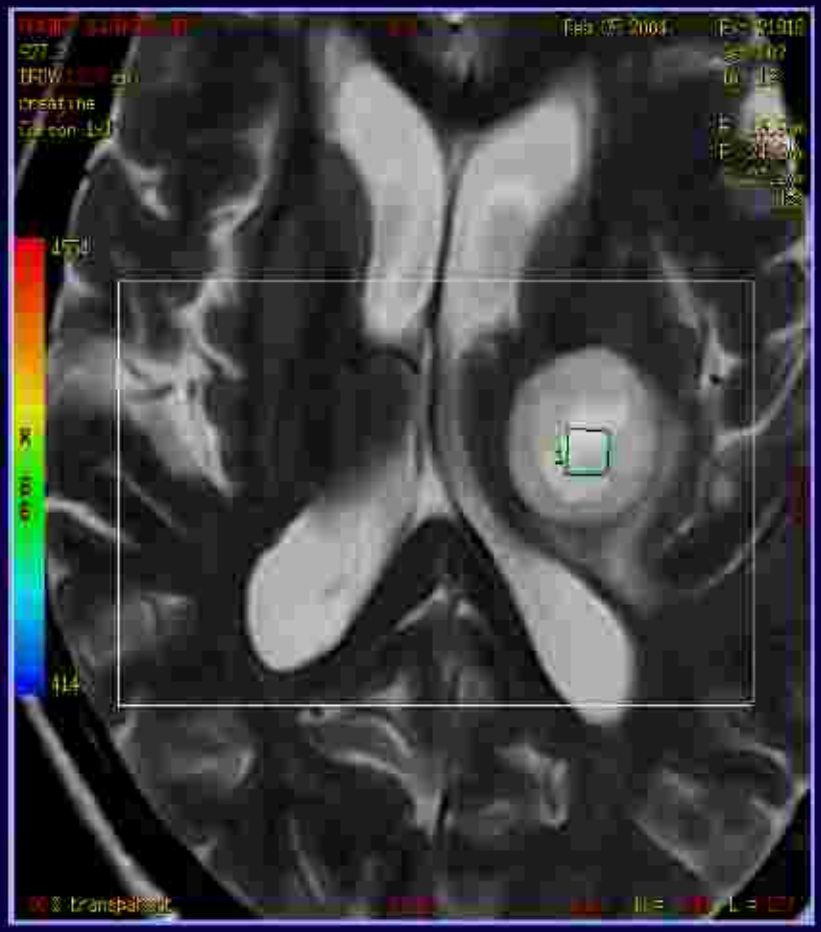
- Delineate residue
- Delineate post-operative parenchymal defect
- Extended for an incomplete study – spinal imaging

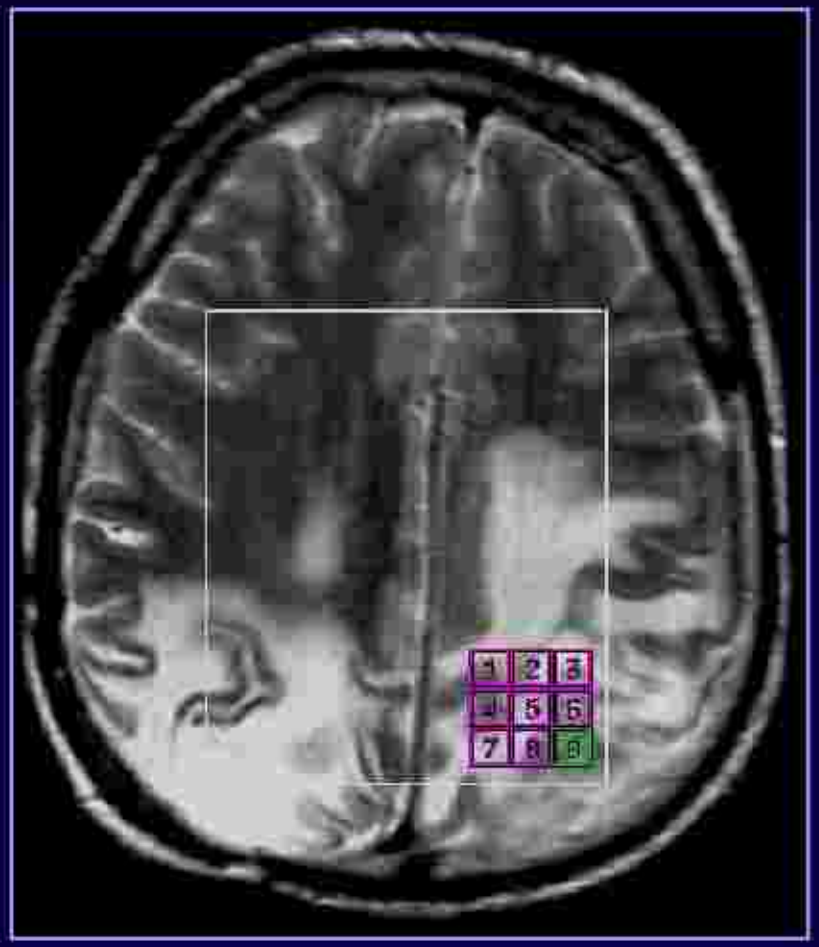
Treatment changes in the tumor bed



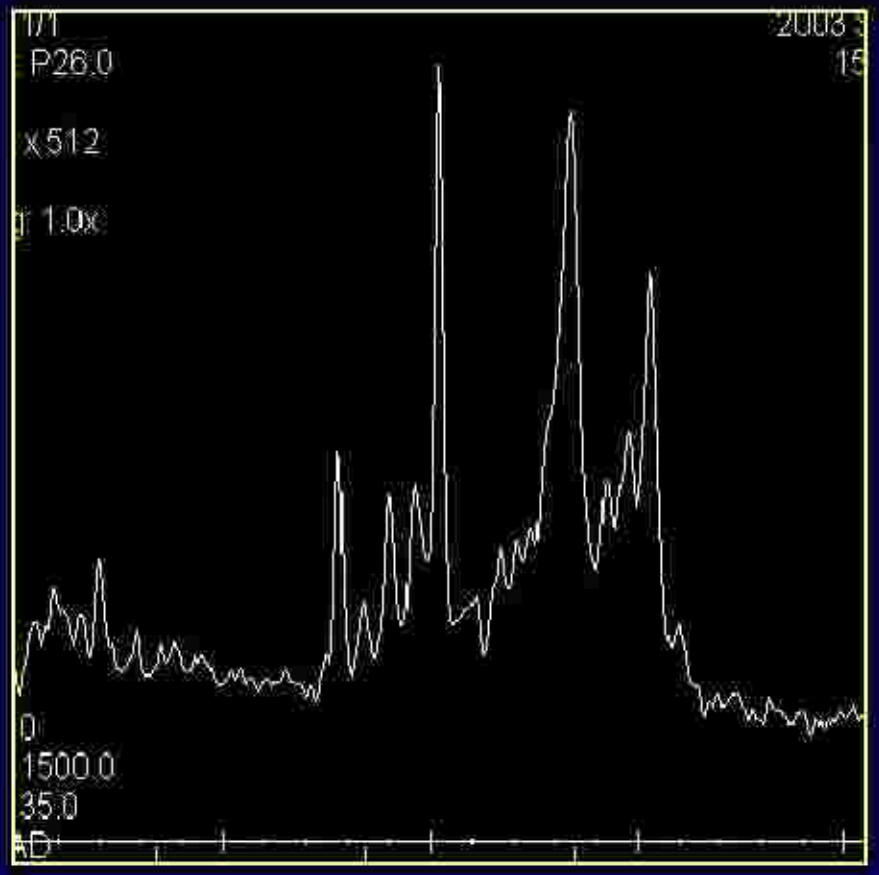
Recurrence

Appearance of a new lesion after radiation treatment

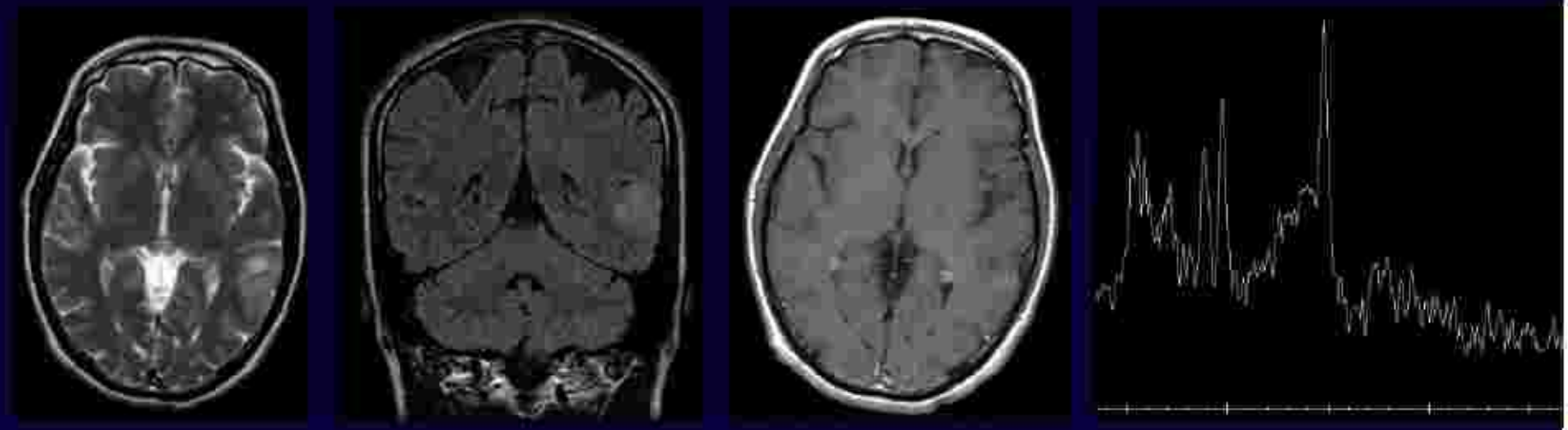




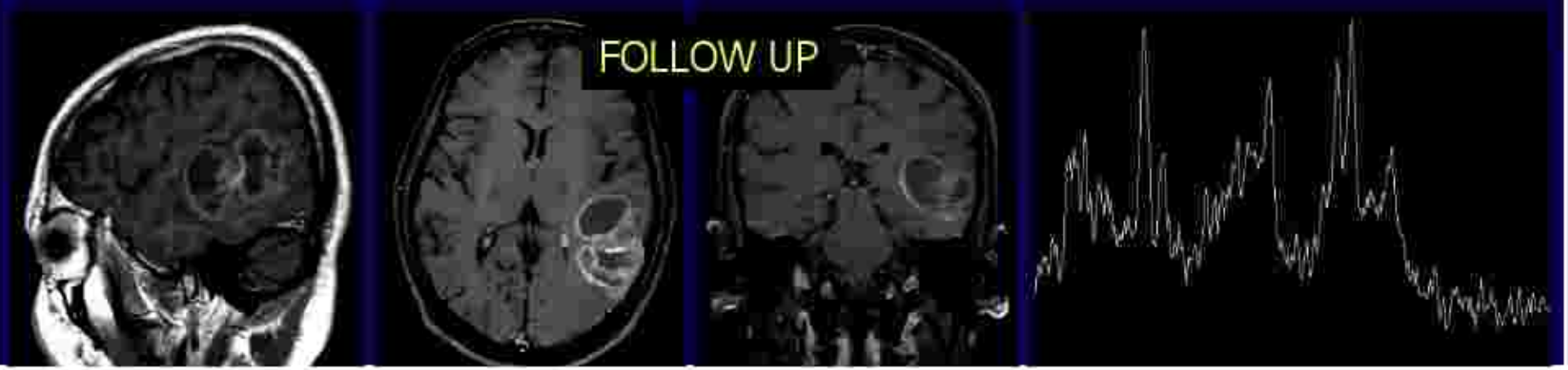
DIFFICULTIES



EARLY GBM



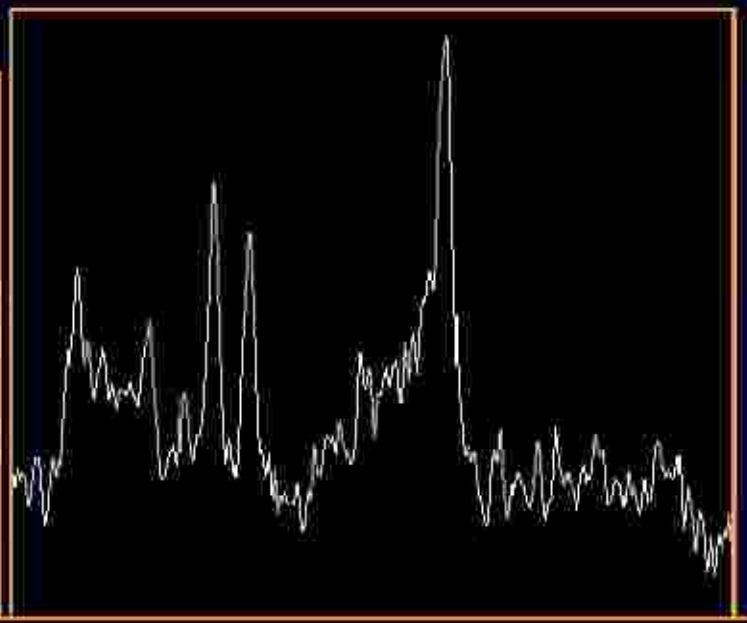
FOLLOW UP

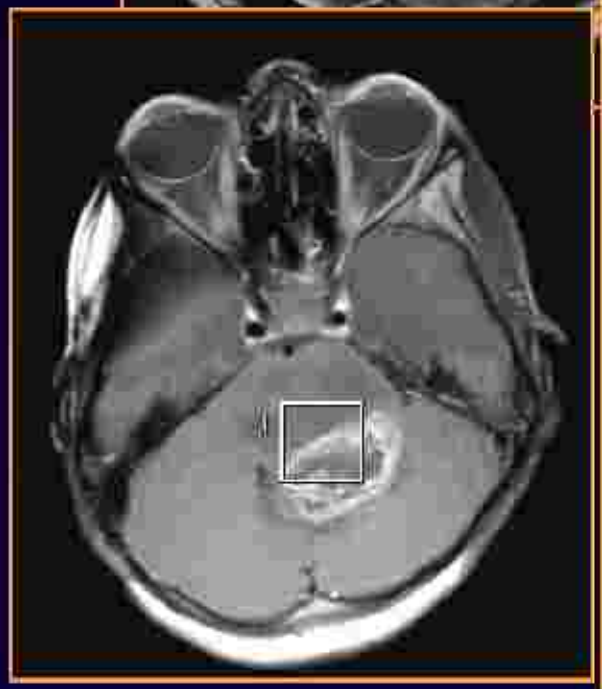


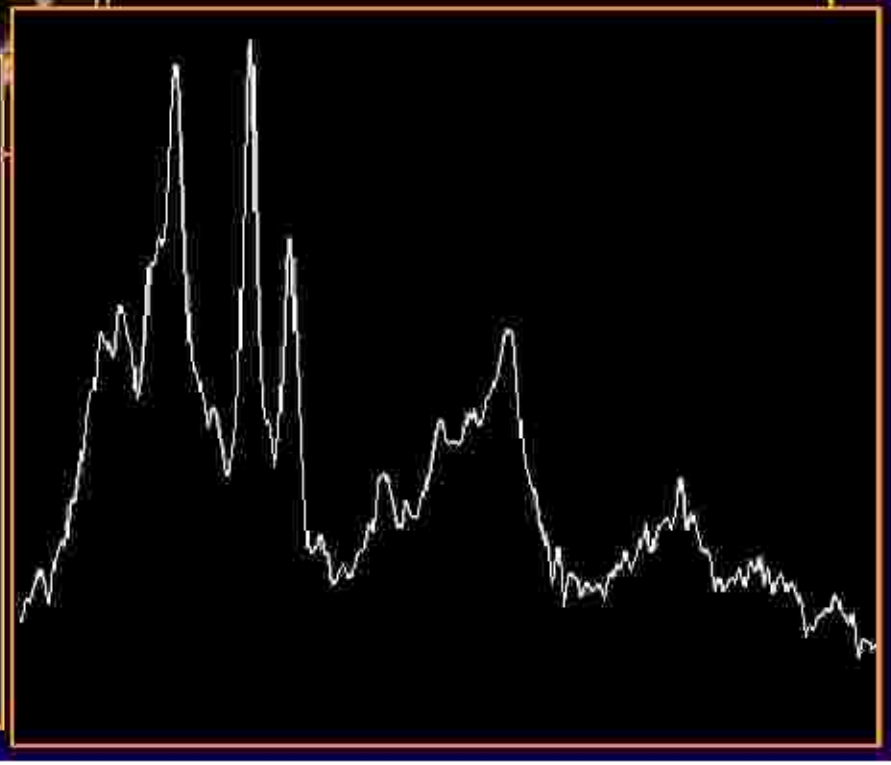
ROLE OF MR SPECTROSCOPY

- Non diagnosed focal lesions
- Confirm diagnosis in diffuse lesions
- Avoided biopsies
- Help superspeciality clinics
- New discovery

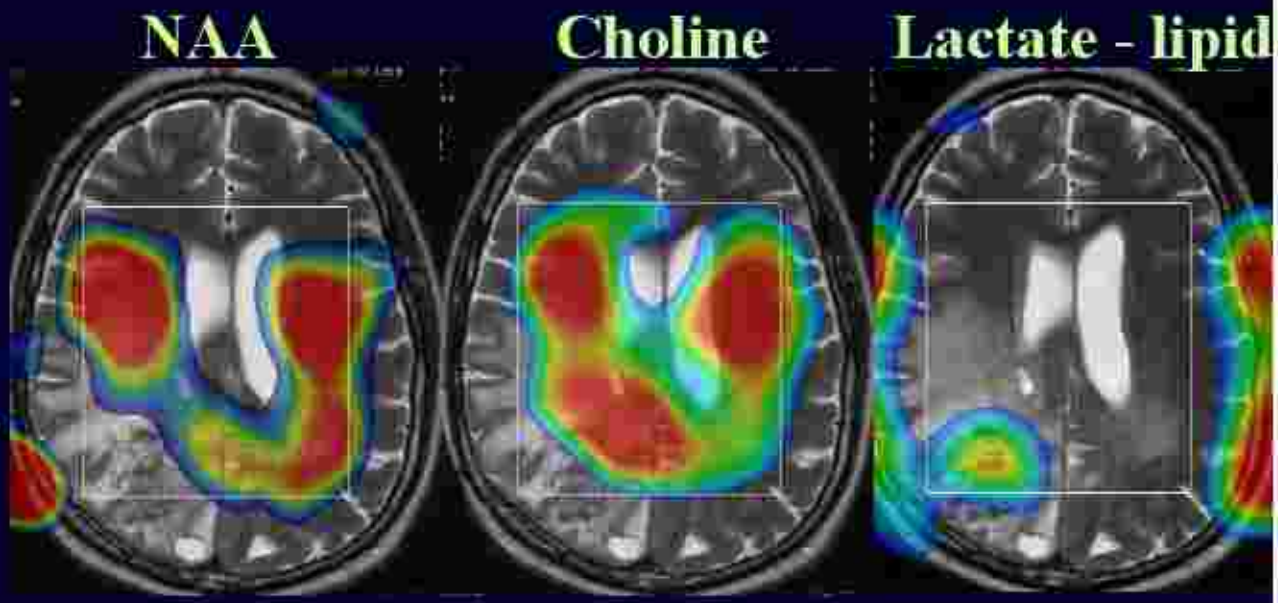
Avoided biopsies

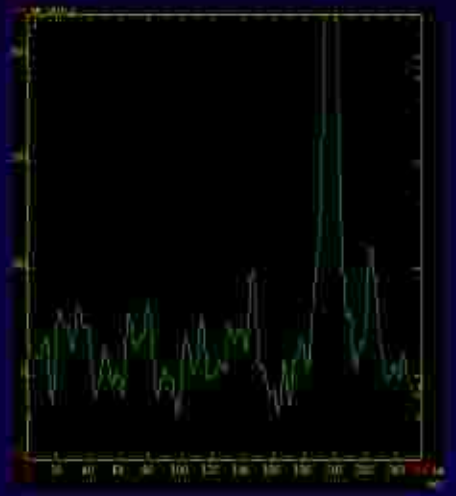


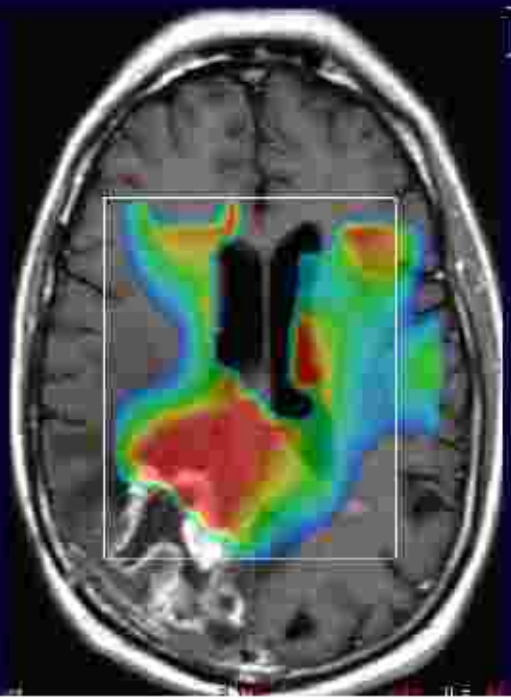




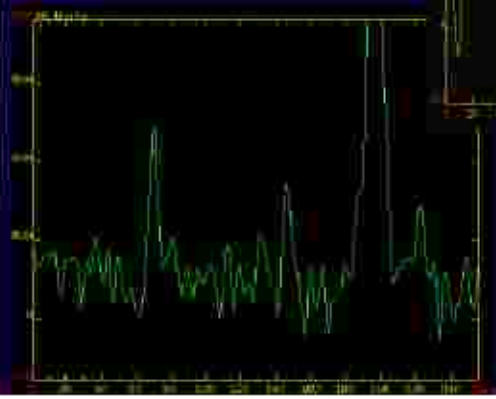
MRI + MRS =
metabolic mapping.

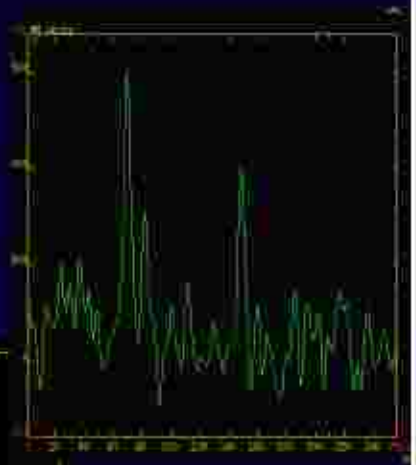






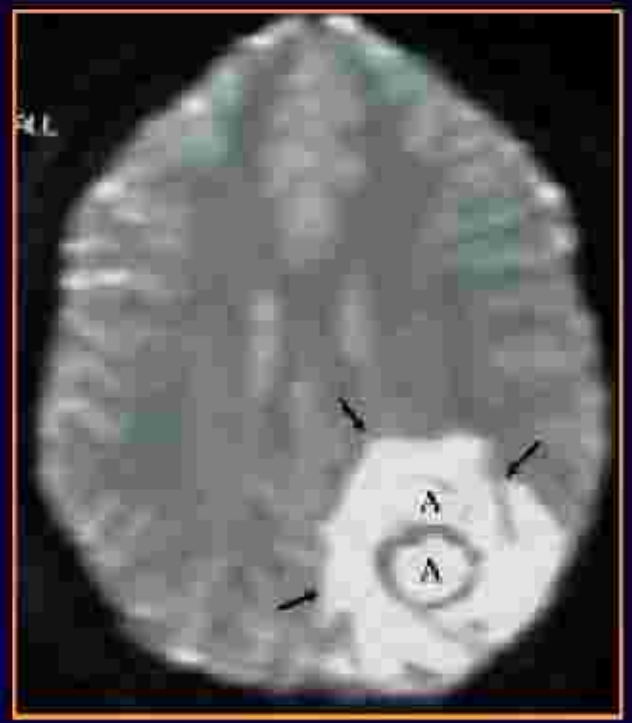
Multi-voxel
MRSI



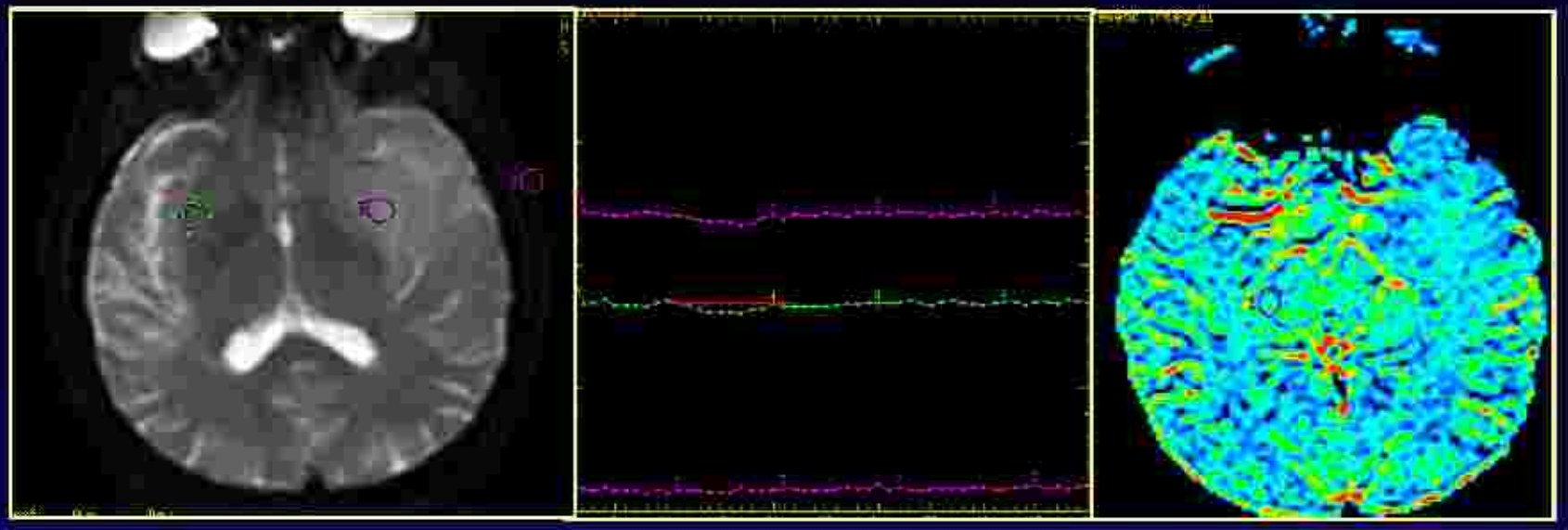


ROLE OF DIFFUSION

- Acute infarct vs tumor
- Abscess vs primary tumor



ROLE OF PERFUSION IMAGING



ROLE OF PET

- False negatives – PET consistent with radiation necrosis, yet subsequent progression of tumor
- False positive in cases of radiation injury which activates repair mechanism
- Expensive and lack of availability
- Decrease in metabolic activity in viable tumors in the immediate postradiation period

Summary

- Radiological assessment based on morphology
- Newer functional MRI techniques can potentially be used to assess "tumor behaviour"
- Take into account age, clinical history and location

INTERACTION

NEUROSURGEON

RADIOLOGIST

Clinical status
Site of biopsy – multiple areas
Specific queries

ONCOLOGIST

PATHOLOGIST

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- JNOM team – TATA & KEM Hospital
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Thank you