



# Radiological Imaging in Neuro-oncology

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# Objectives:

- Review the role of MRI in resection and radiotherapy of brain tumors
- Review advanced MRI techniques in characterization of gliomas
- Review the role of MRI and posttreatment follow up

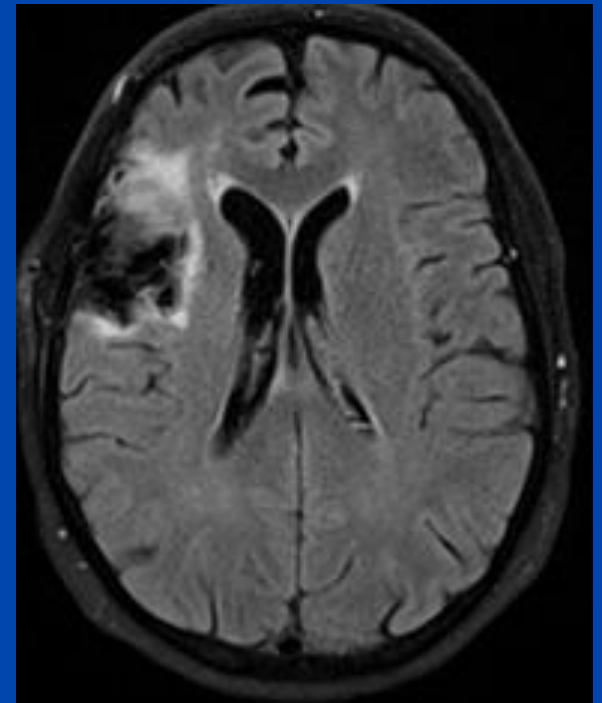
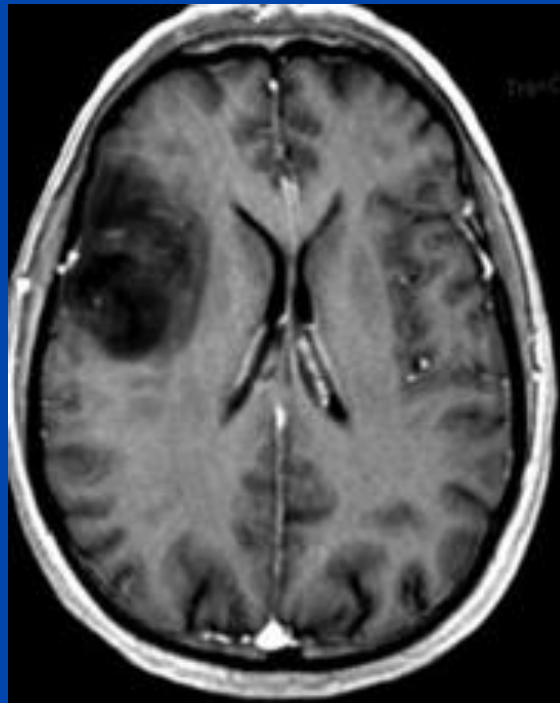
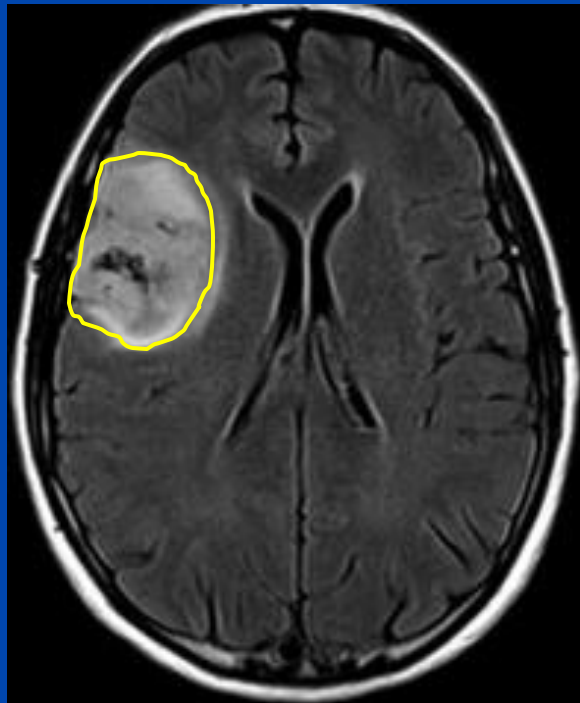
# Role of imaging in neuro-oncology

- Structural MRI plays a central clinical role in diagnosis, characterization, surveillance and therapeutic monitoring of CNS tumors.
- Even though the conventional T1/ T2 MR signal and contrast enhancement lack biological specificity, resection and radiation treatment rely on MR signal and contrast enhancement.

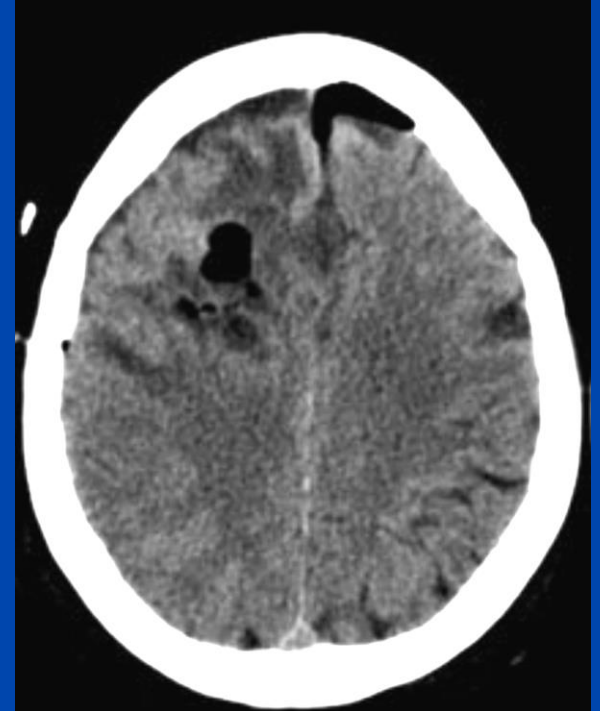
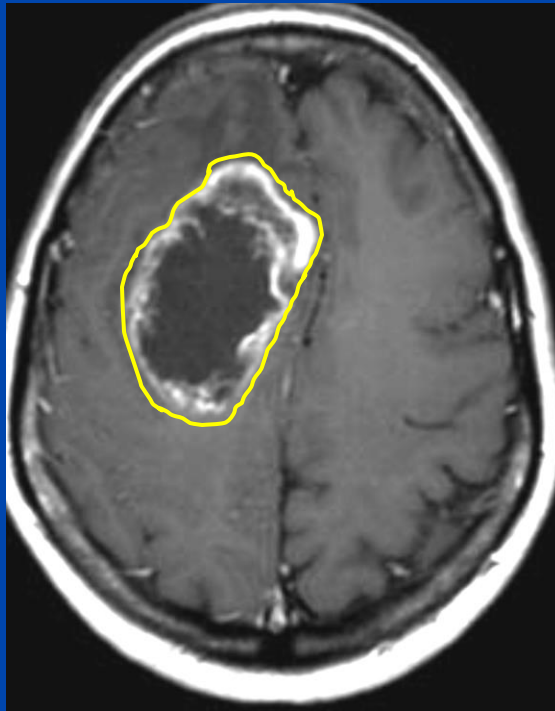
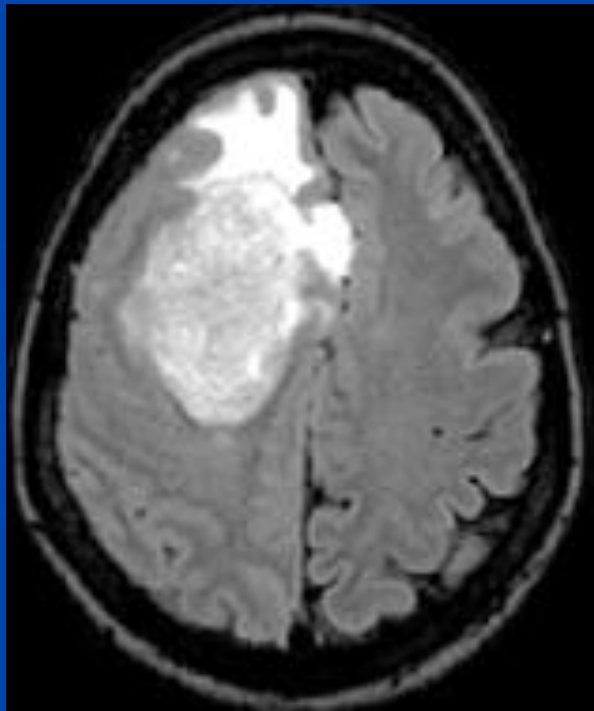
# MR signal in resection and radiation planning

- Resection of non-enhancing tumors is guided by T2/T2-FLAIR signal
- In large and extensively infiltrated tumors, the enhancing component is the primary target for resection
- In radiotherapy, enhancement and T2 signal help define Gross, and Clinical Target Volume (GTV, CTV)

# Resection guided by T2-FLAIR: marginal resection



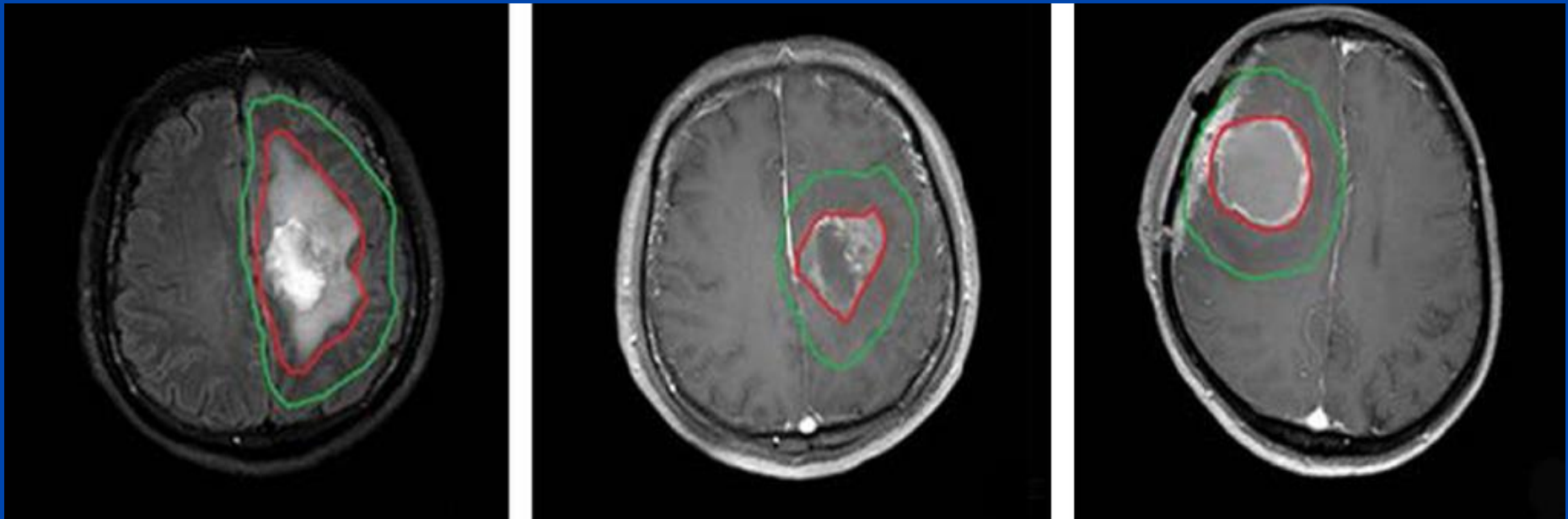
# Resection guided by enhancement



# GTV (red) and CTV (green)

## Current treatment planning tends to include:

- Contrast-enhancing tumor on T1-weighted MRI with a 2 cm margin, or
- FLAIR/T2-weighted abnormality on the postoperative MRI scan with a 1 cm margin



# Contrast enhancement on MRI

- Although pathological contrast enhancement is generally associated with more aggressive lesions, up to one-third of non-enhancing gliomas are malignant.
- Certain low-grade tumors, notably gangliogliomas and pilocytic astrocytomas, some grade II oligodendrogliomas and rarely, low-grade astrocytomas show enhancement.
- Contrast enhancement alone is therefore a limited differentiator between high-grade gliomas and LGGs in an individual patient.



# New MR techniques that provide additional characterization

- Perfusion MRI

High vascularity correlates with tumor grade, and genotype (IDH mutation status) and helps differentiate recurrence of high-grade lesions from post-treatment changes.

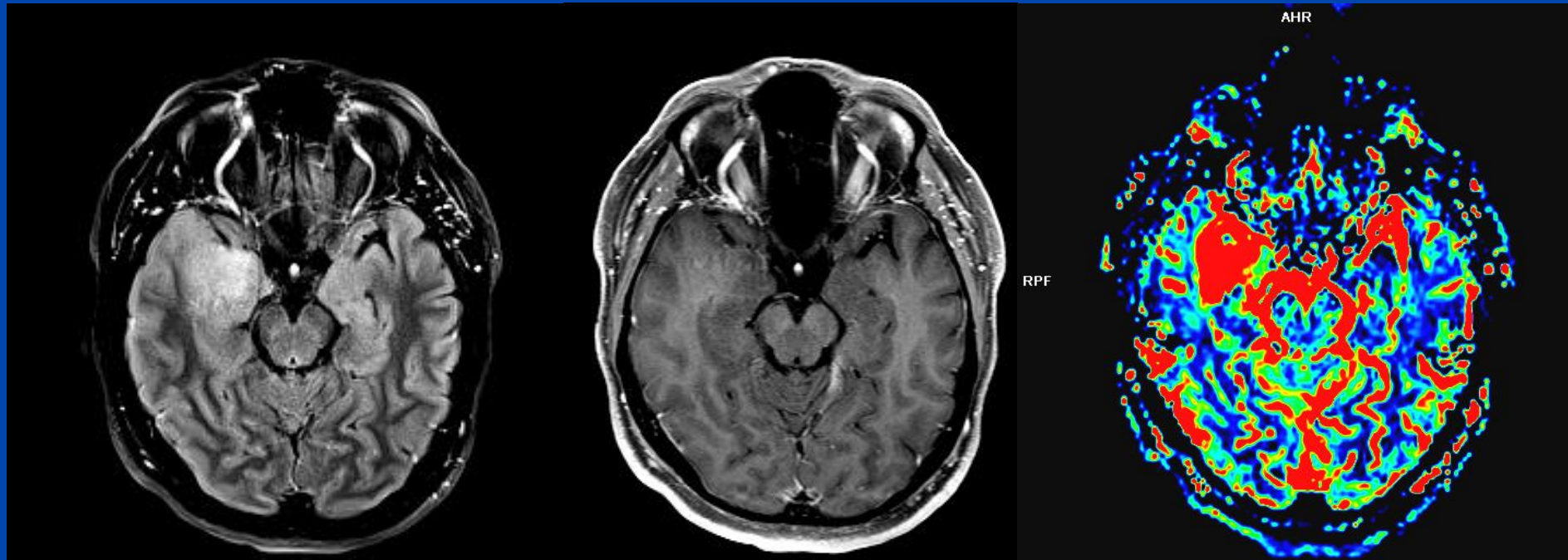
- Diffusion-weighted MRI

Low ADC values as a marker of tumor cellularity correlate with tumor grade

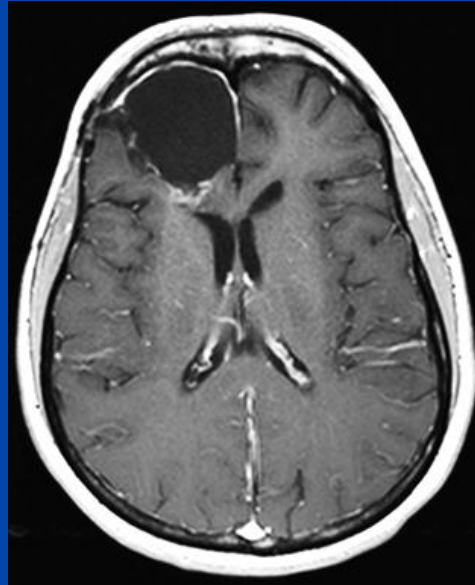
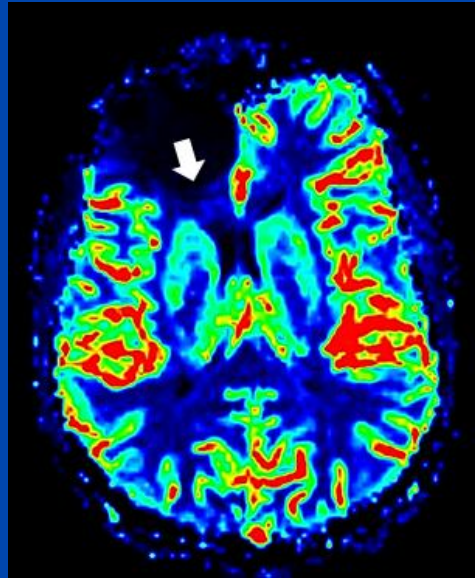
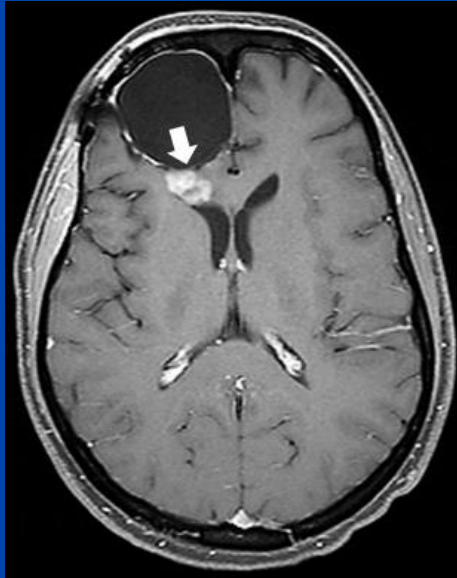
- MR spectroscopy

Elevated Choline as a marker of cell membrane turnover helps distinguish recurrence from post-treatment changes

# Infiltrative nonenhancing highly vascular right temporal tumor: IDH wild grade 3 astrocytoma



# Pseudoprogression: hypoperfused lesion spontaneously resolving on follow up



# Radiation necrosis: spontaneously resolved hypoperfused lesion

