Perfusion MR Imaging: tumoral responses to treatment

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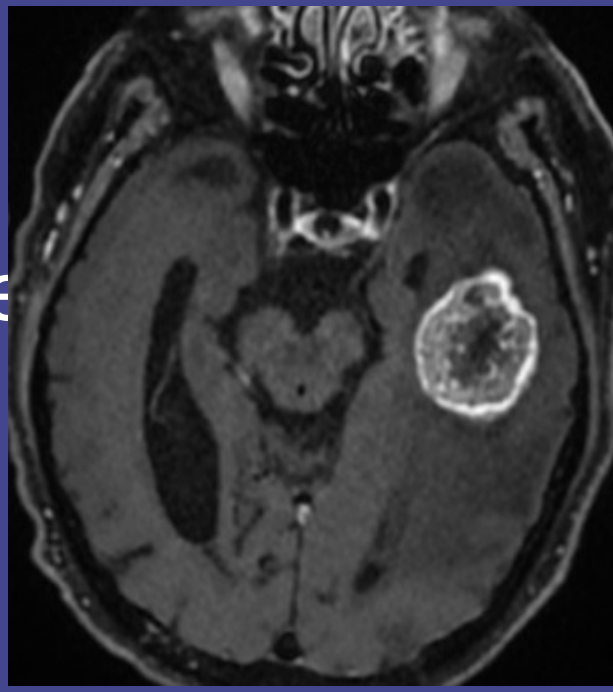
I have no conflict of interest

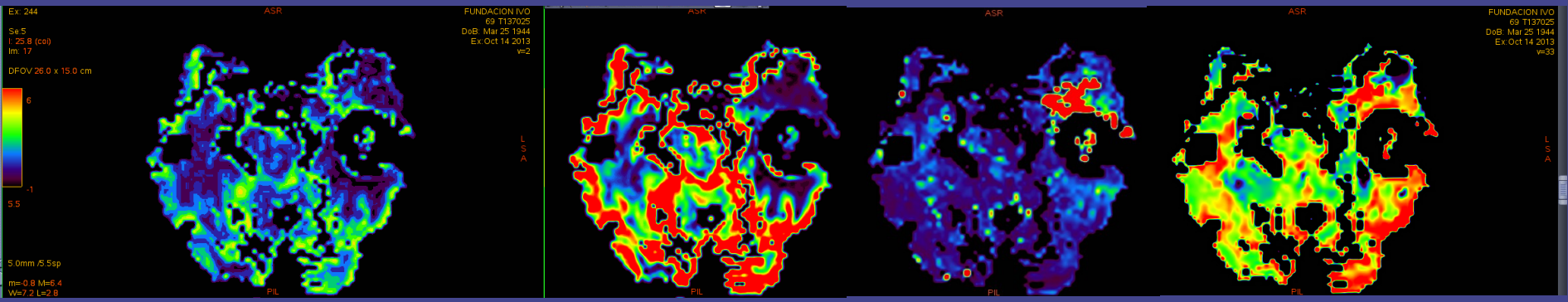
Index

- Technical tips
- Primary brain tumors
  - Progression
  - Pseudoprogression
  - Pseudoresponse
- Metastases

Parameters DSC T2*



- rCBV, rCBF, mean transit time, time to peak
- rCBV
  - most robust
  - most related to cell and vascular density



Technique

- Whi
- Bas
- Alw
- Unc
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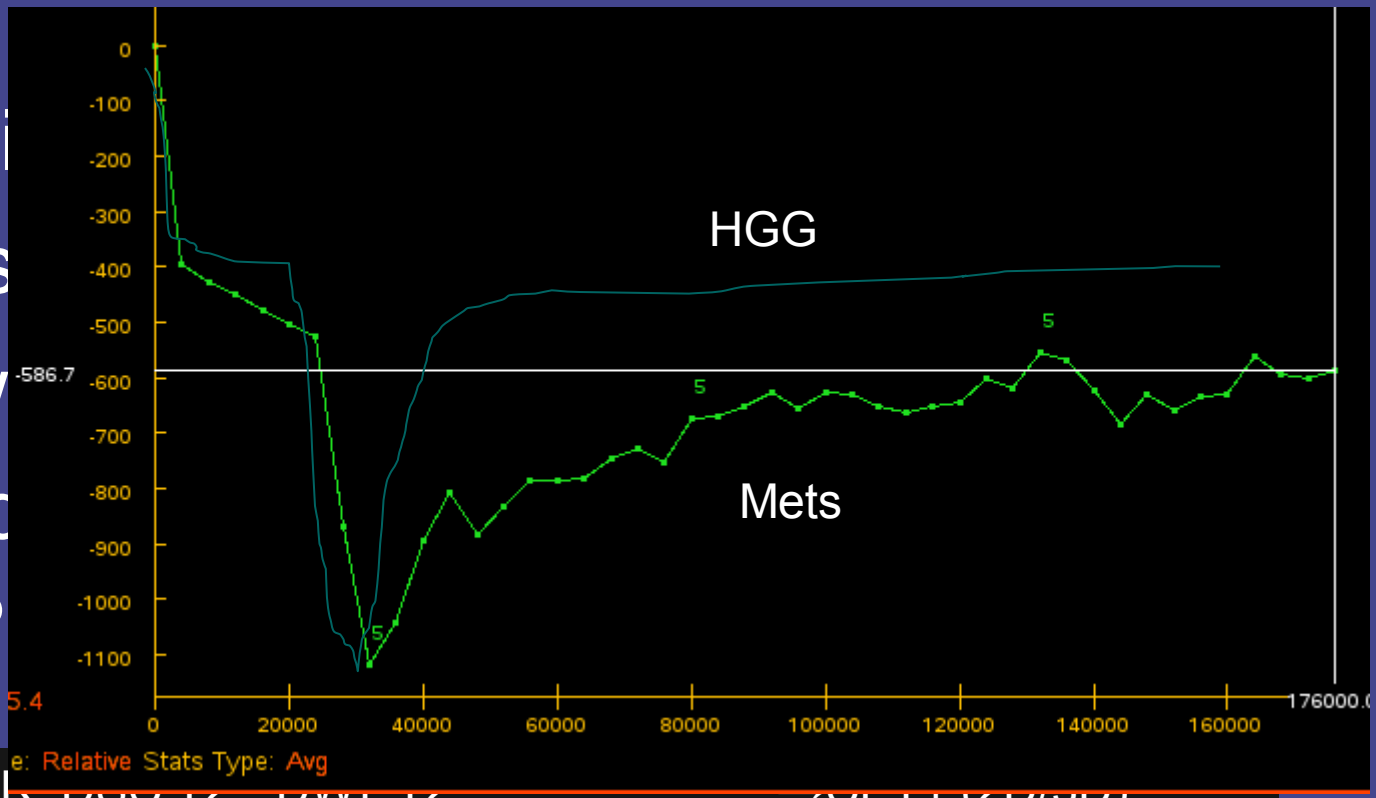
  - ↓



T1, FLAIR, DSC T2*, DWI, T2, >SE T1 (2D/3D)

6 min

not affected by gadolinium

AJNR Am J Neuroradiol 2008;29:419-424

Current imaging markers

Does MR Perfusion Imaging Impact Management Decisions for Patients with Brain Tumors? A Prospective Study

RESULTS: Fifty-nine consecutive subjects with glial tumors were evaluated; 50 had known pathologic diagnoses. NRs and the treatment team agreed on tumor status in 45/50 cases ($\kappa = 0.81$). With the addition of perfusion, confidence in status assessment increased in 20 (40%) for NRs and in 28 (56%) for the treatment team. Of the 59 patient-care episodes, the addition of perfusion was associated with a change in management plan in 5 (8.5%) and an increase in the treatment team's confidence in their management plan in 34 (57.6%). NRs and the treatment team found perfusion useful in most episodes of care and wanted perfusion included in future MR images for >80% of these subjects.

CONCLUSIONS: Perfusion imaging appears to have a significant impact on clinical decision-making and subspecialist physicians' confidence in management plans for patients with brain tumor.

AJNR Am J Neuroradiol 2012 33: 556-562

RANO

Criteria	CR	PR	SD	PD
Enhancing disease	None	≥50% ↓	<50% ↓ but <25% ↑	≥25% ↑[a]
T2/FLAIR	Stable or ↓	Stable or ↓	Stable or ↓	↑[a]
New lesion	None	None	None	Present[a]
Corticosteroids	None	Stable or ↓	Stable or ↓	NA[b]
Clinical status	Stable or ↑	Stable or ↑	Stable or ↑	↓[a]
Requirement for response	All	All	All	Any[a]

CR, complete response; NA, not applicable; PD, progressive disease; PR, partial response; SD, stable disease.
a Progression occurs when criterion present.
b Corticosteroid dose increase alone is not considered in determining disease progression when there is no persistent clinical deterioration.

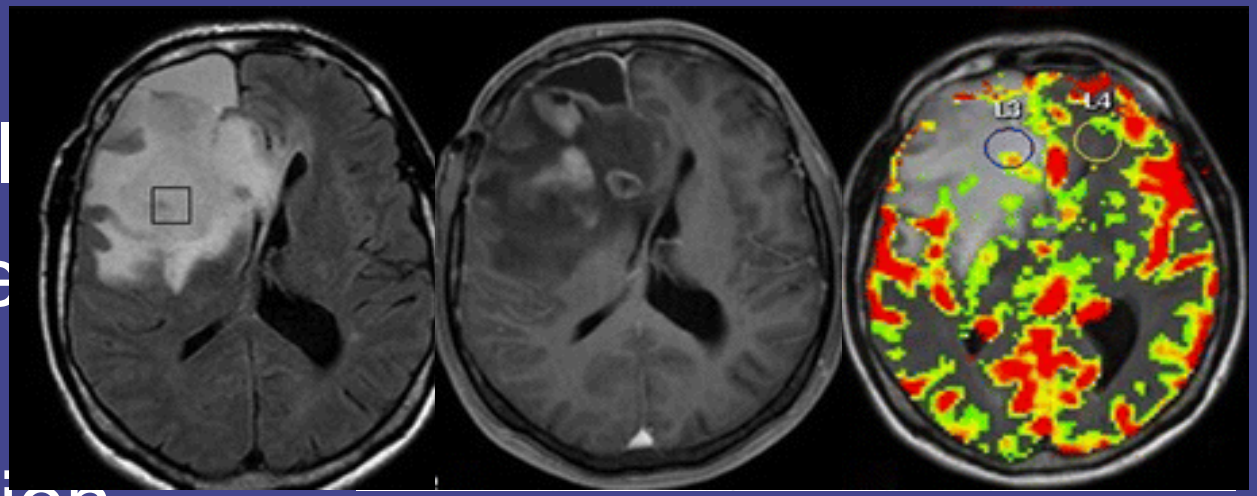
J Clin Oncol 2010;28:1963–72

RANO limitations

- Definition of significant ↑ T2/FLAIR
- Nonenhancing T2/FLAIR tumor progression vs radiation effects, demyelination,etc..
- Signficant change corticosteroid dose
- Lack of validated measures of neurologic function

Magn Reson Imaging Clin N Am 2013;21:241-268

Low grade glioma

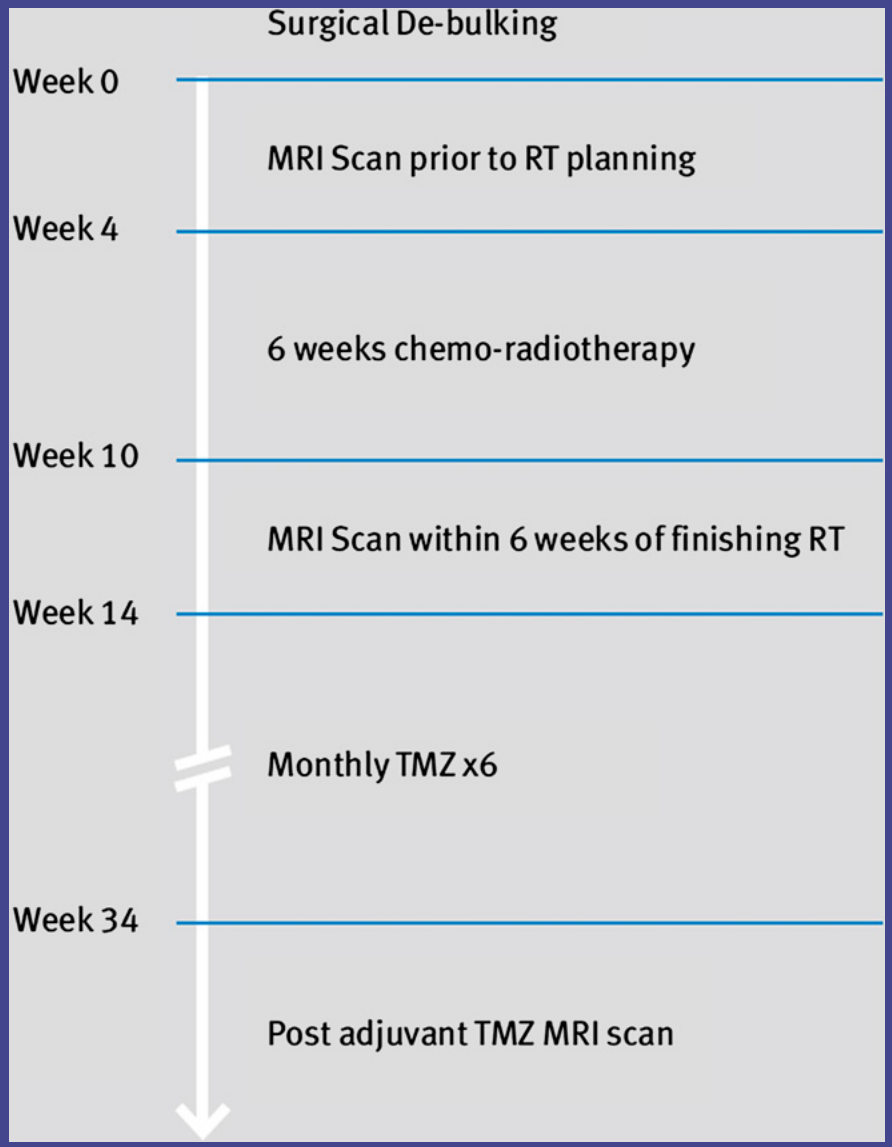


- rCBV basel
- ↑rCBV 1 ye
  - rCBV > 1
    progression
- Oligodendroglioma: ↑rCBV , esp. 1p/19q loss
- Low rCBV of nontransforming LGG not a biomarker (floor effect)

J Neuro-Oncol 2010; 97:73-80
Magn Reson Imaging Clin N Am 2013;21:241-268

Imaging schedule

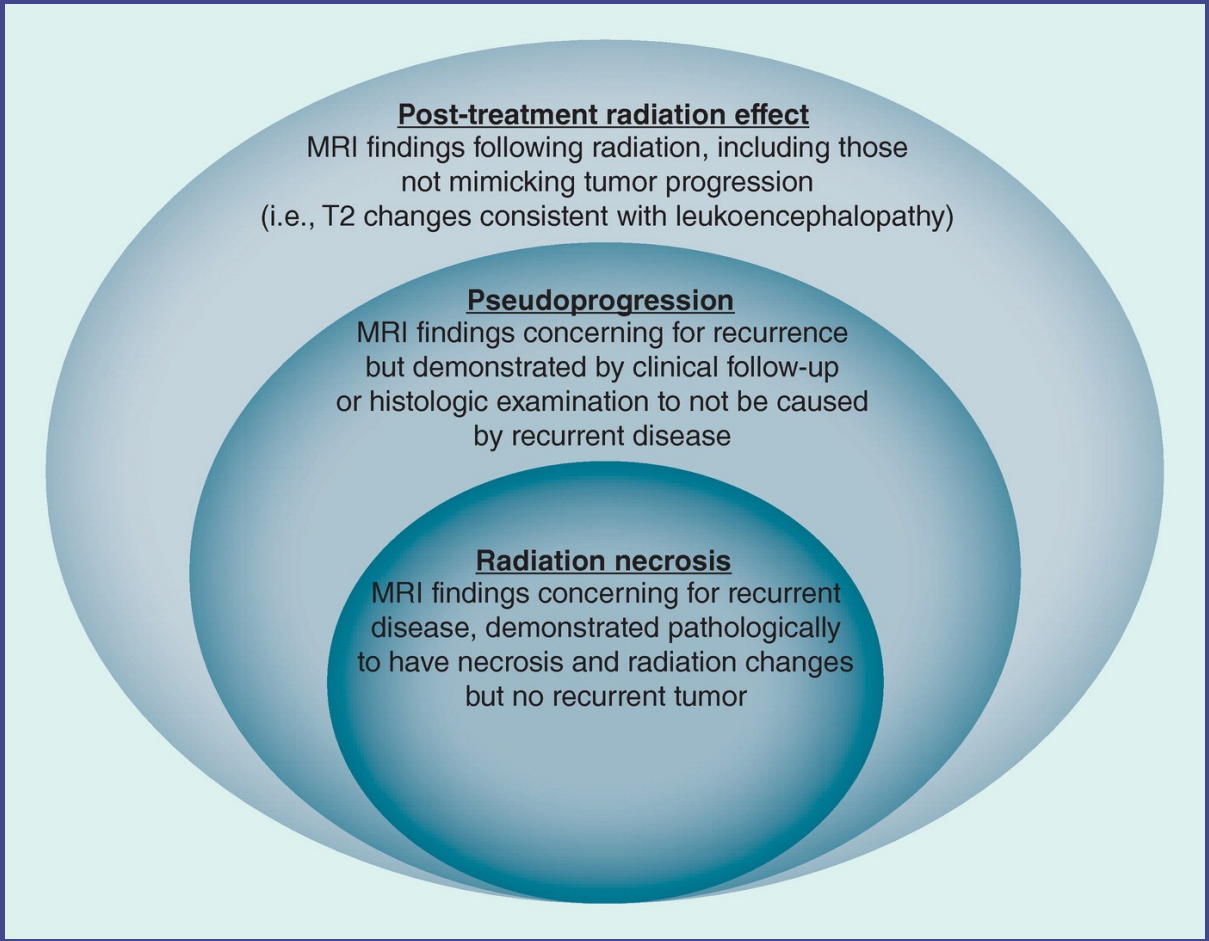
Baseline diagnosis



- Perfusion always
- ↓ rCBV after 1 week vs preRT, better
- Dexamethasone doesn't affect

Survival prediction in high-grade gliomas by MRI perfusion before and during early stage of RT Int J Radiat Oncol Biol Phys. 2006 ;64:876-85

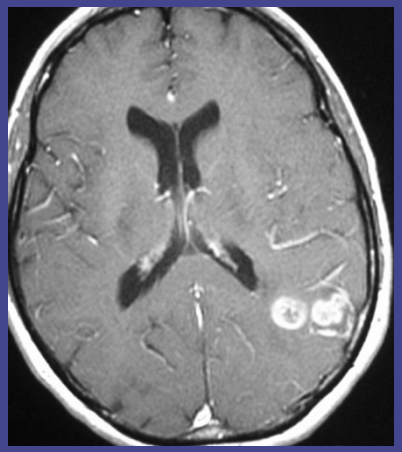
Spectrum of findings



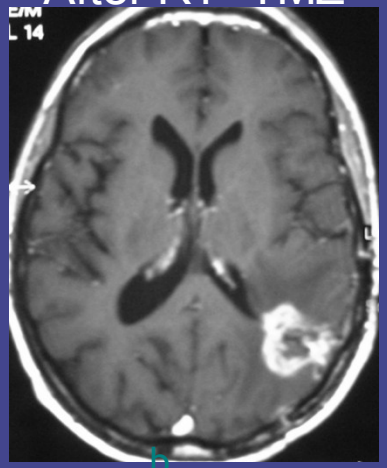
Expert Review of Neurotherapeutics 2013;13:389-403

Confidence

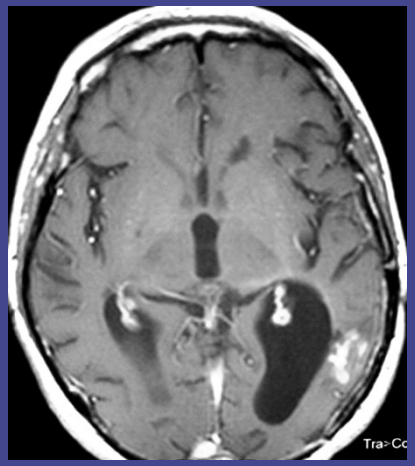
Baseline

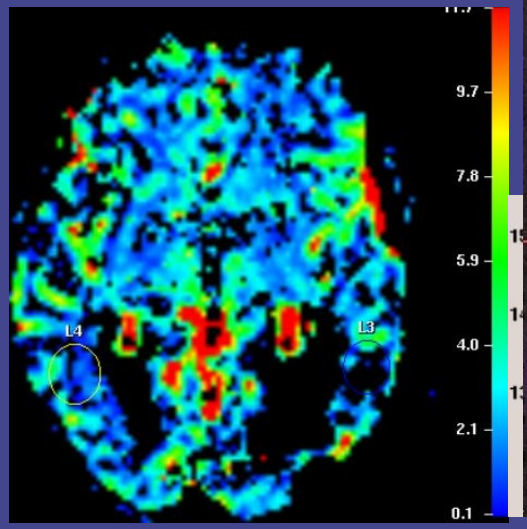


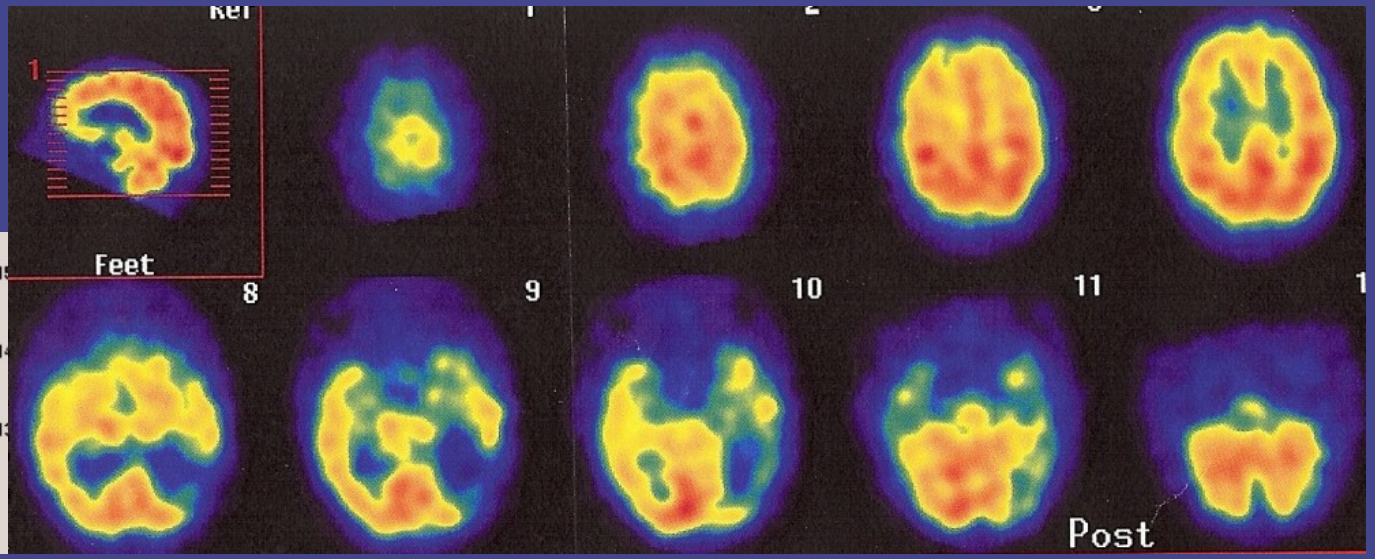
After RT+TMZ



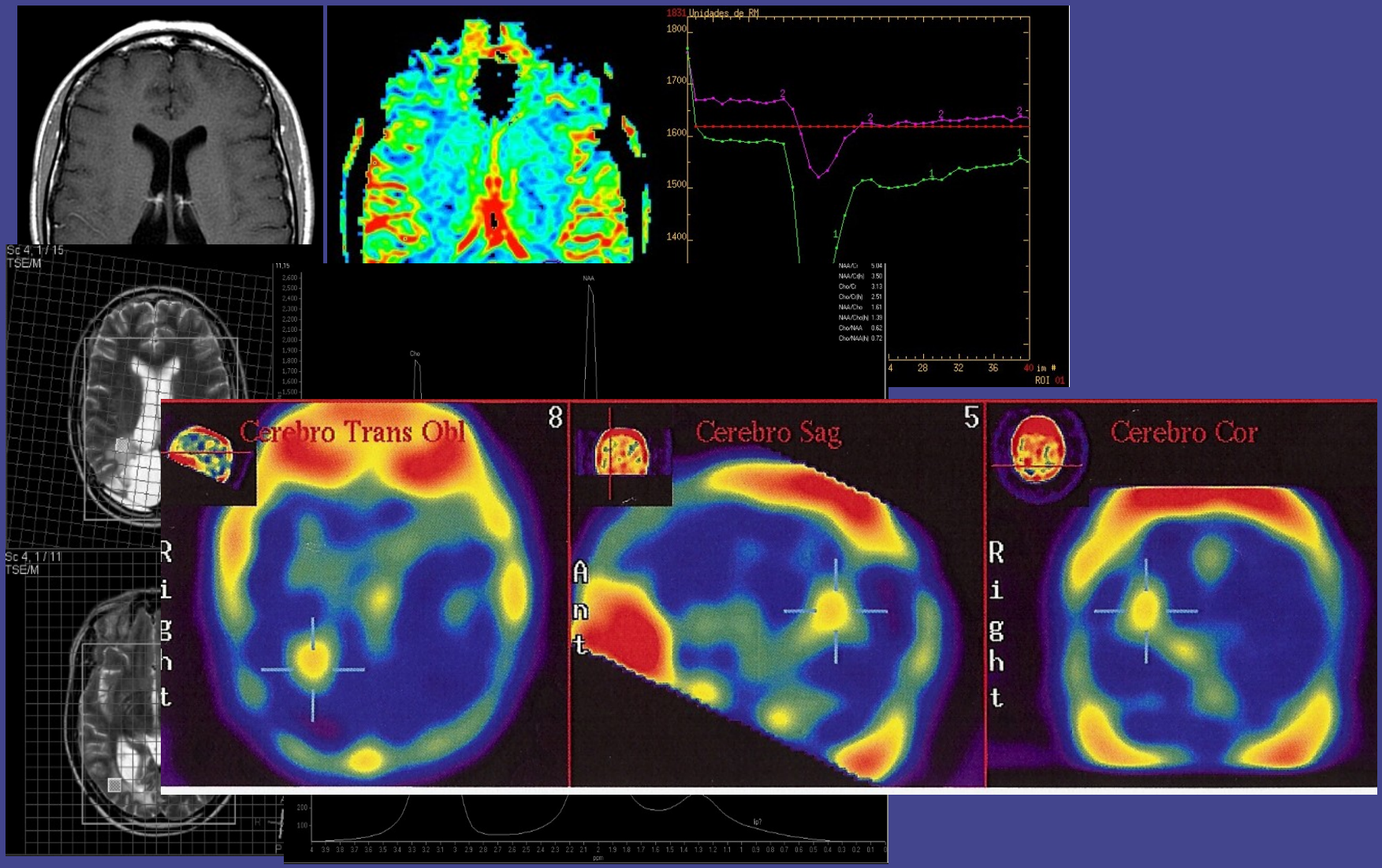
After radiosurgery







Progression

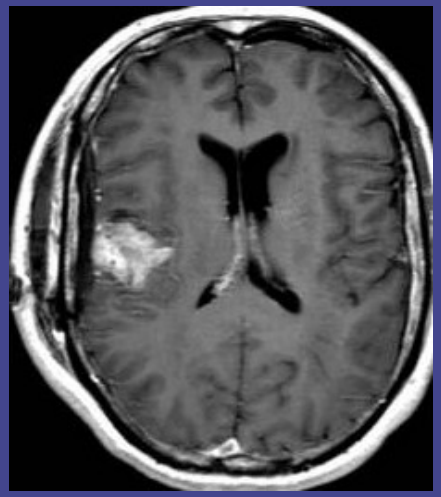


Pseudoprogression

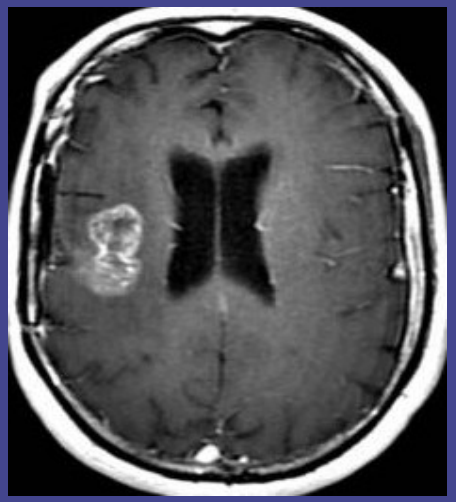
- No strict definition
- ↑ CET1 **3** to 6 Ms after chemoradiation
- Most asymptomatic, 33% may require some therapy
- Retrospective diagnosis based
- Most powerful informer is sequential imaging

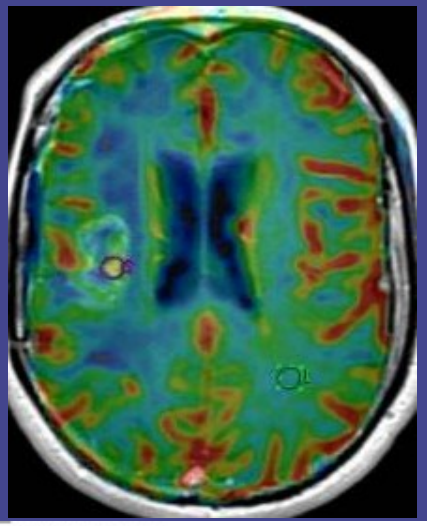
Clin Oncol 2012;24:216-227

After surgery

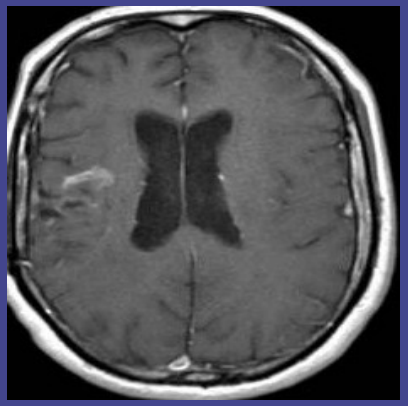


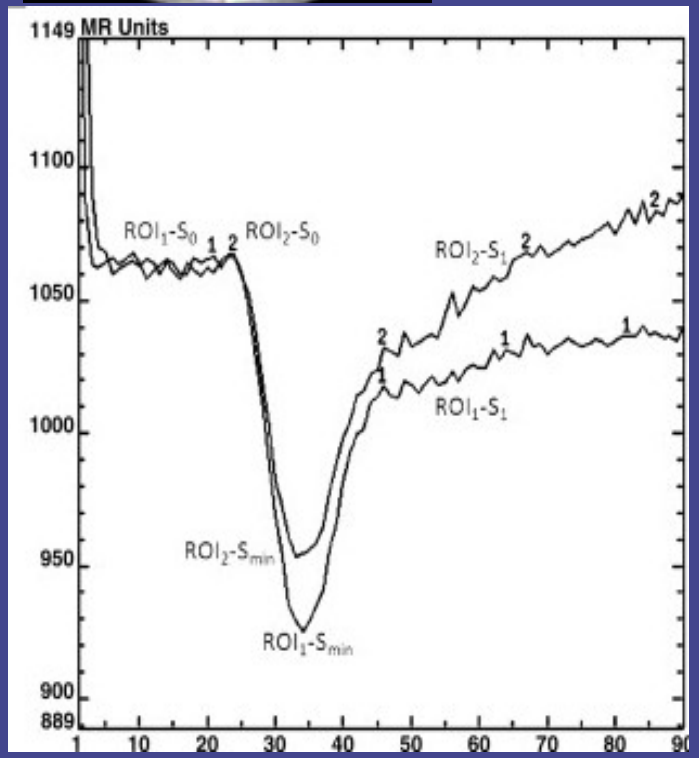
3Ms after RT+TMZ





rCBV 1.1

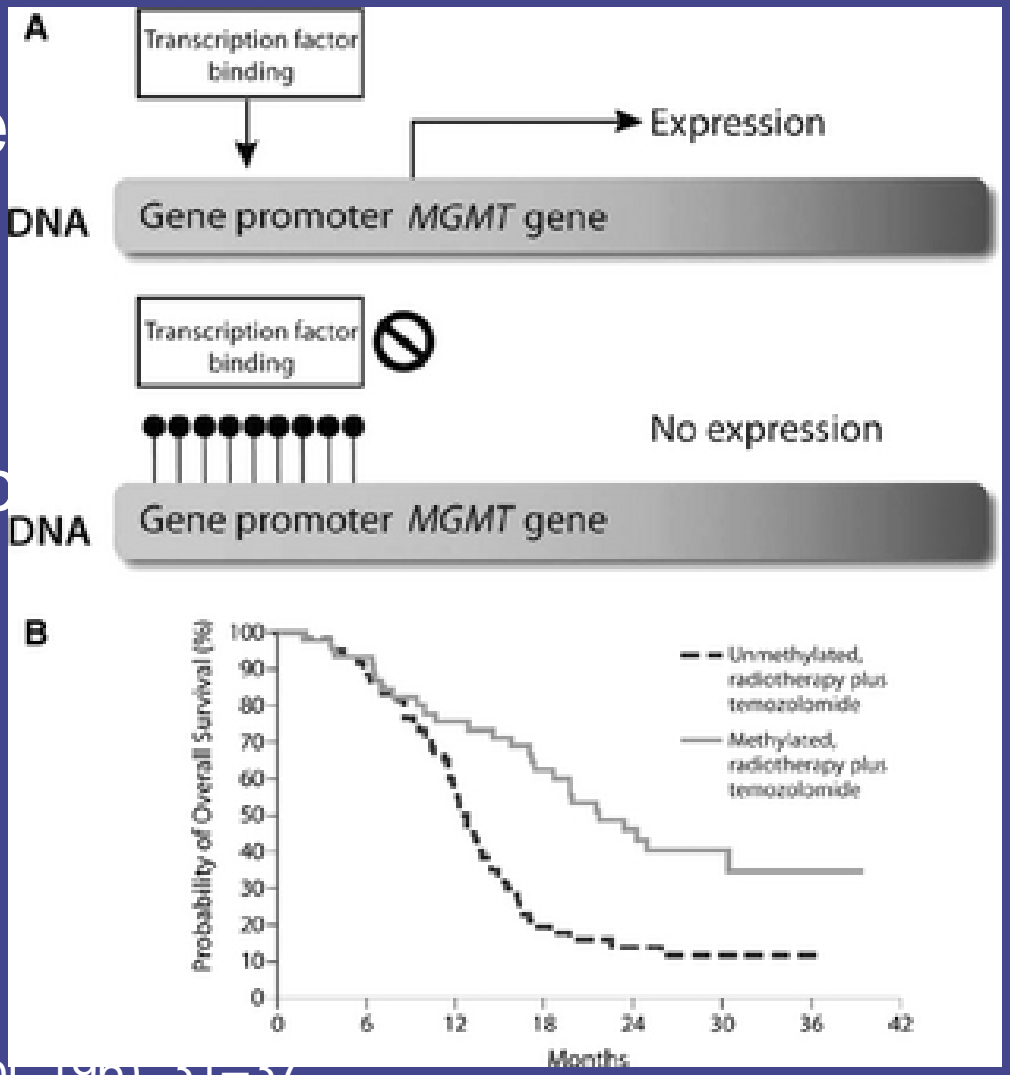




Clinical Imaging 2013;37:41 - 49

Pseudoprogression and MGMT TMZ

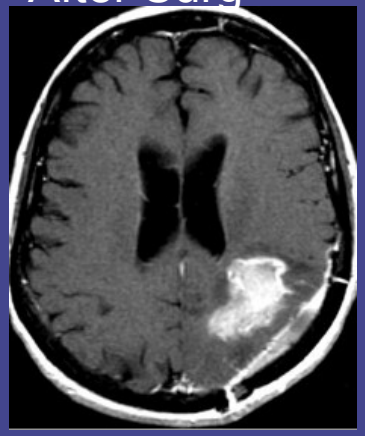
- Methylated: bette
- Mild ↑rCBV: PsP
- Unmethylated:
  - rCBV > 1.47 prob



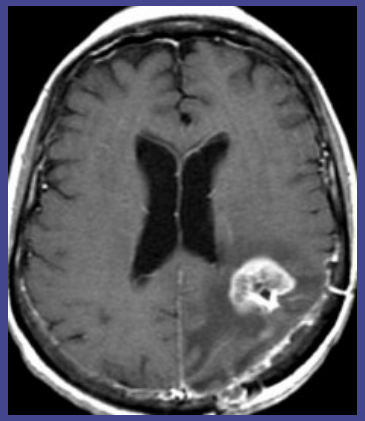
Acta Neurol Scand 2013: 127 (Suppl. 196): 31–37
AJNR 2011;32:382-387

MGMT unmethylated

After Surg

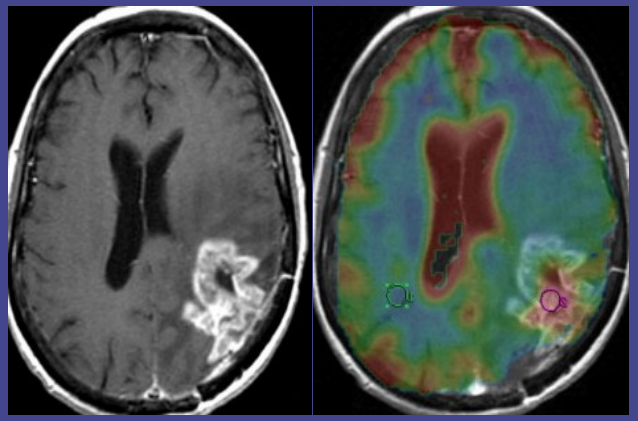


1M RT+TMZ



rCBV 1.5

2M after RT



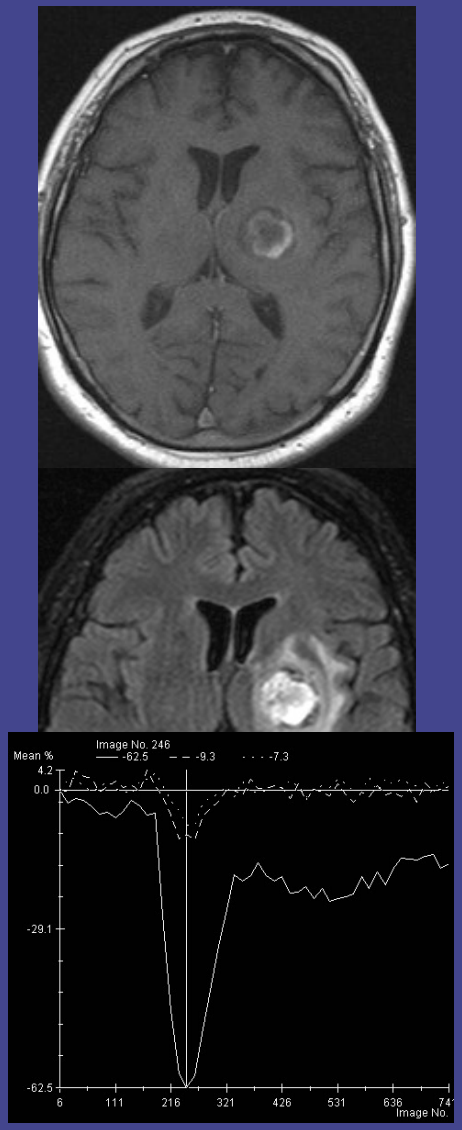
rCBV 3.5

Clin Imag 2013;37: 41 - 49

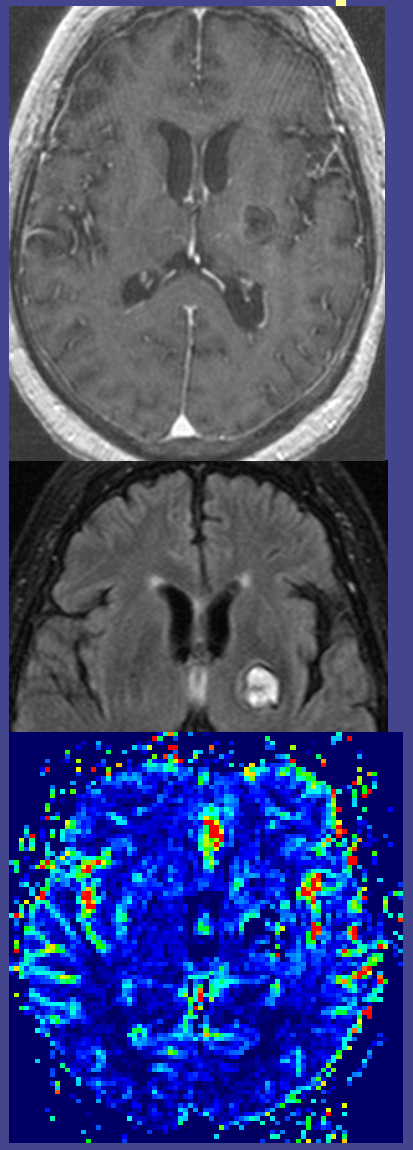
Pseudoresponse
Antiangiogenic, bevacizumab

- ↓ permeability due to vascular normalization rather than antitumoral effect
- ↑ T2/FLAIR, tumor progression, invasive nonenhancing
- ↓ morbidity and steroid usage

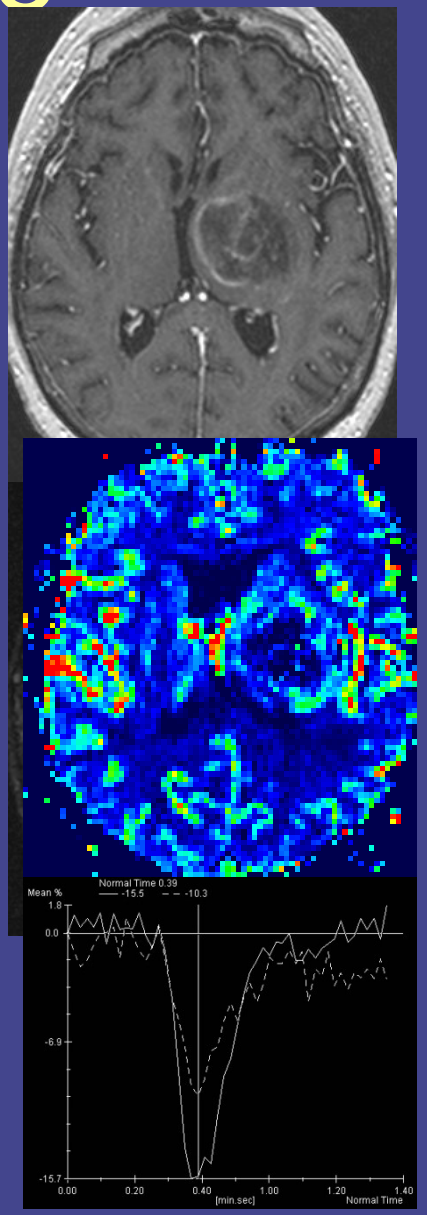
Pseudoresponse



rCBV 6,72



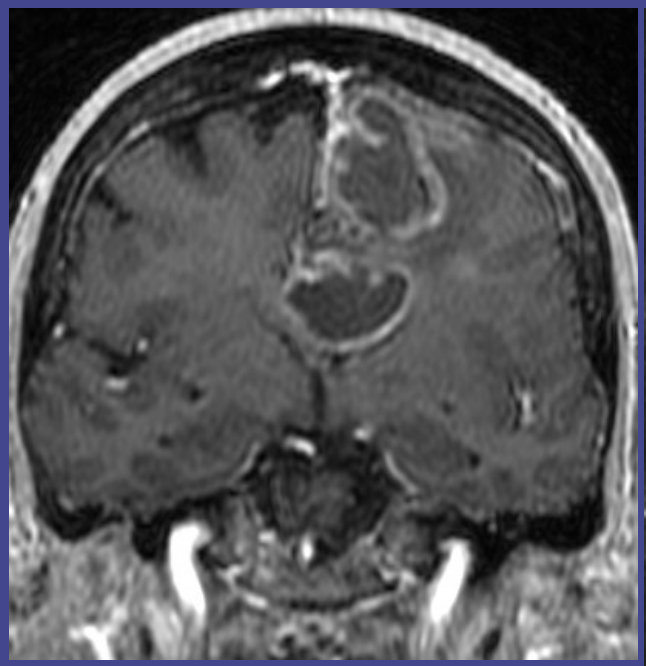
rCBV 1,9



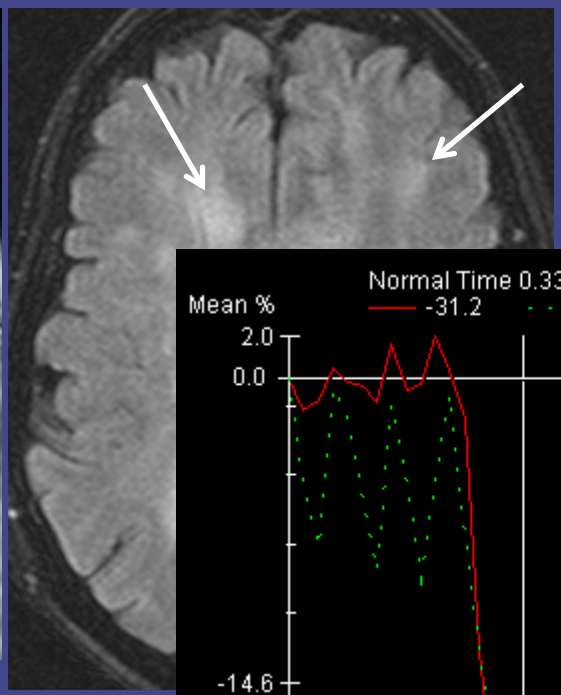
rCBV 1,5

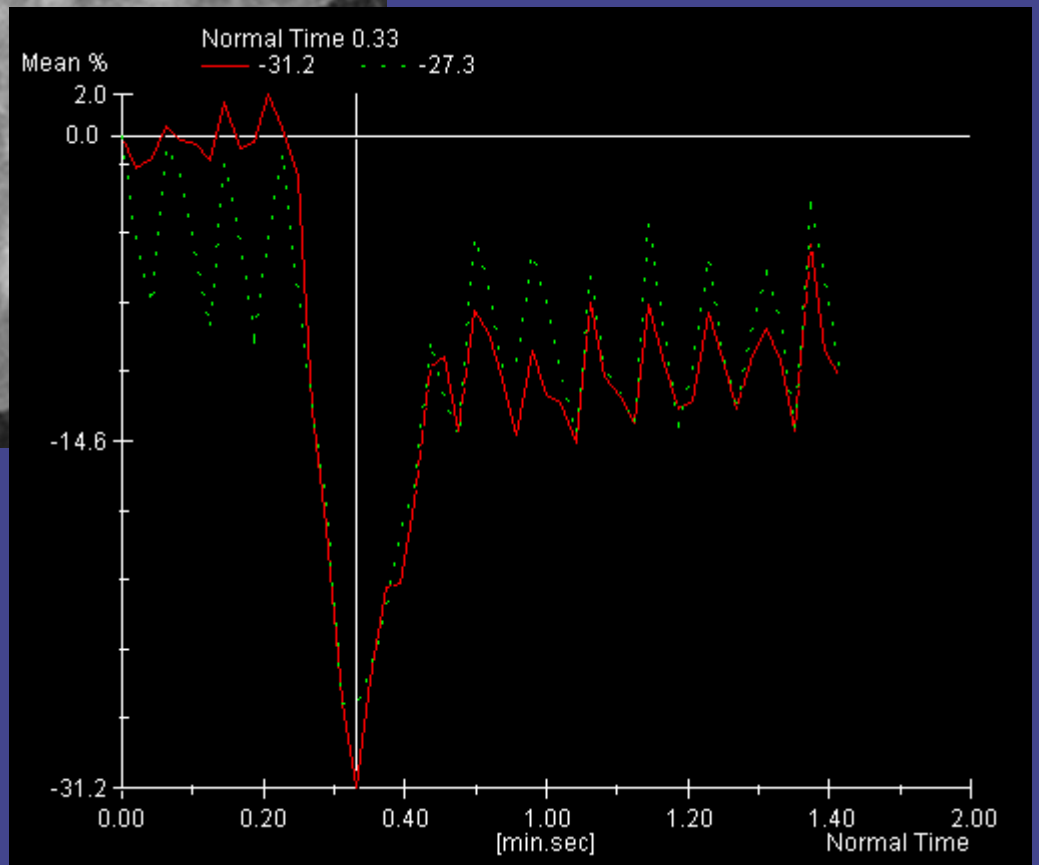
New T2 lesions

Baseline



4M TMZ+BVM





Radiation necrosis

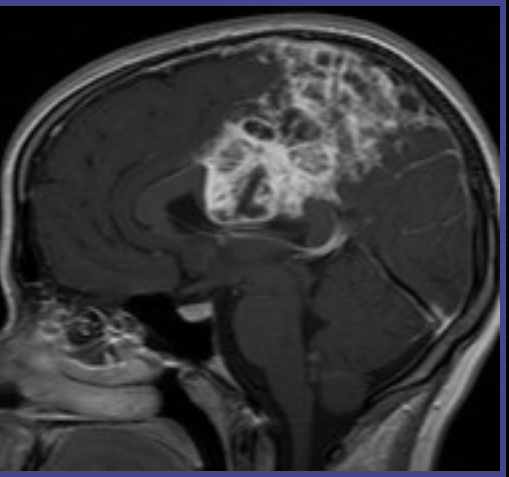
- Months to years after therapy
- Indicence unclear, aprox. 24%
- Conventional T1 unreliable to recurrence

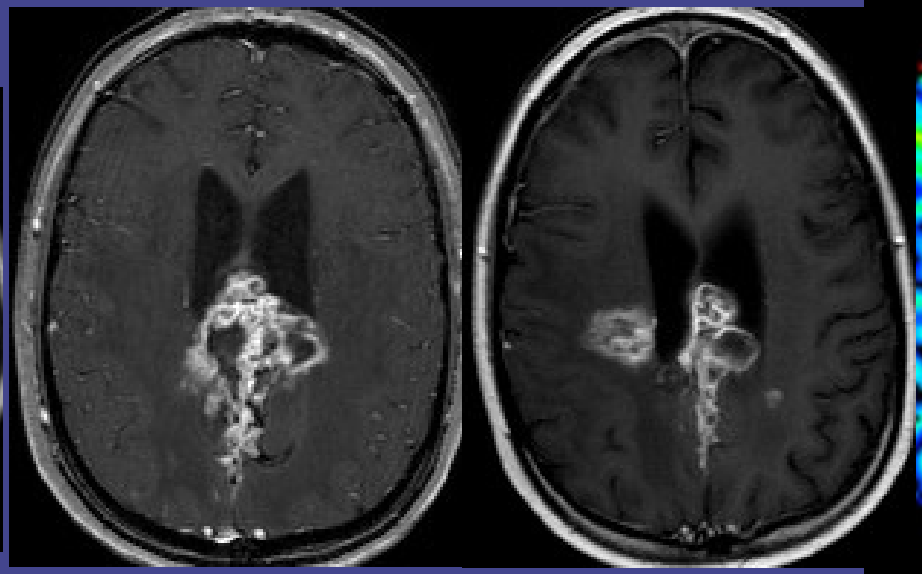
Radionecrosis and more

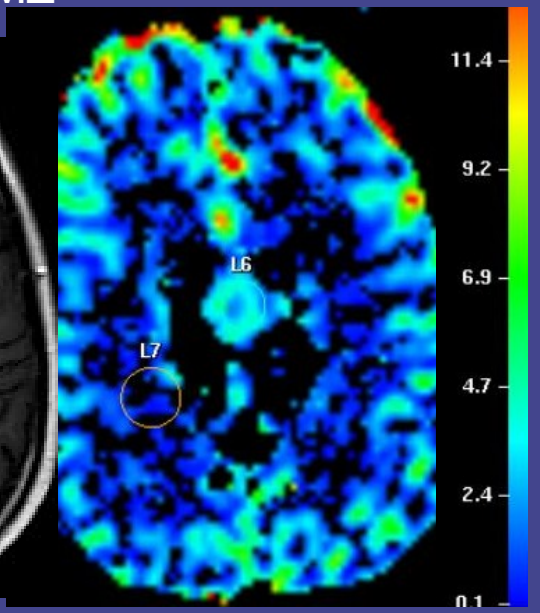
Baseline

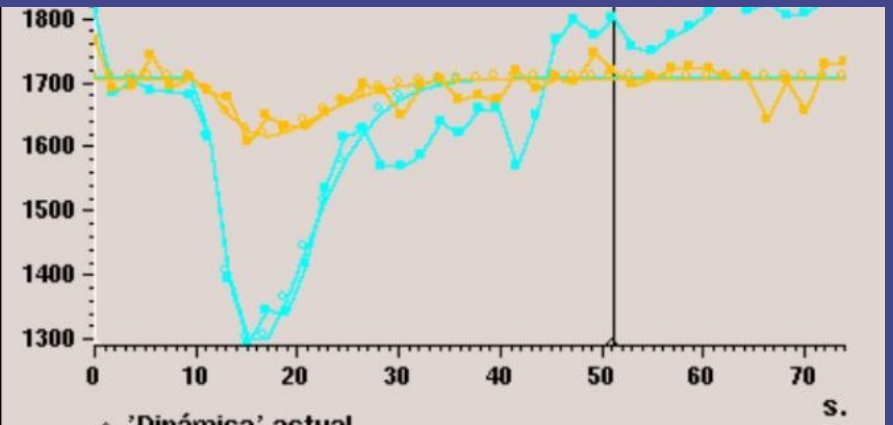
After surgery

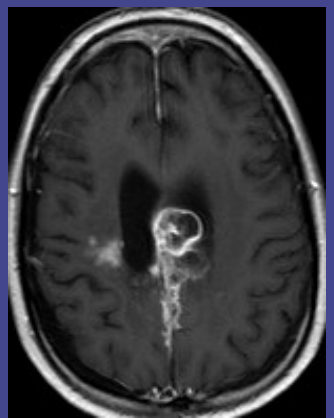
10M later RT+TMZ





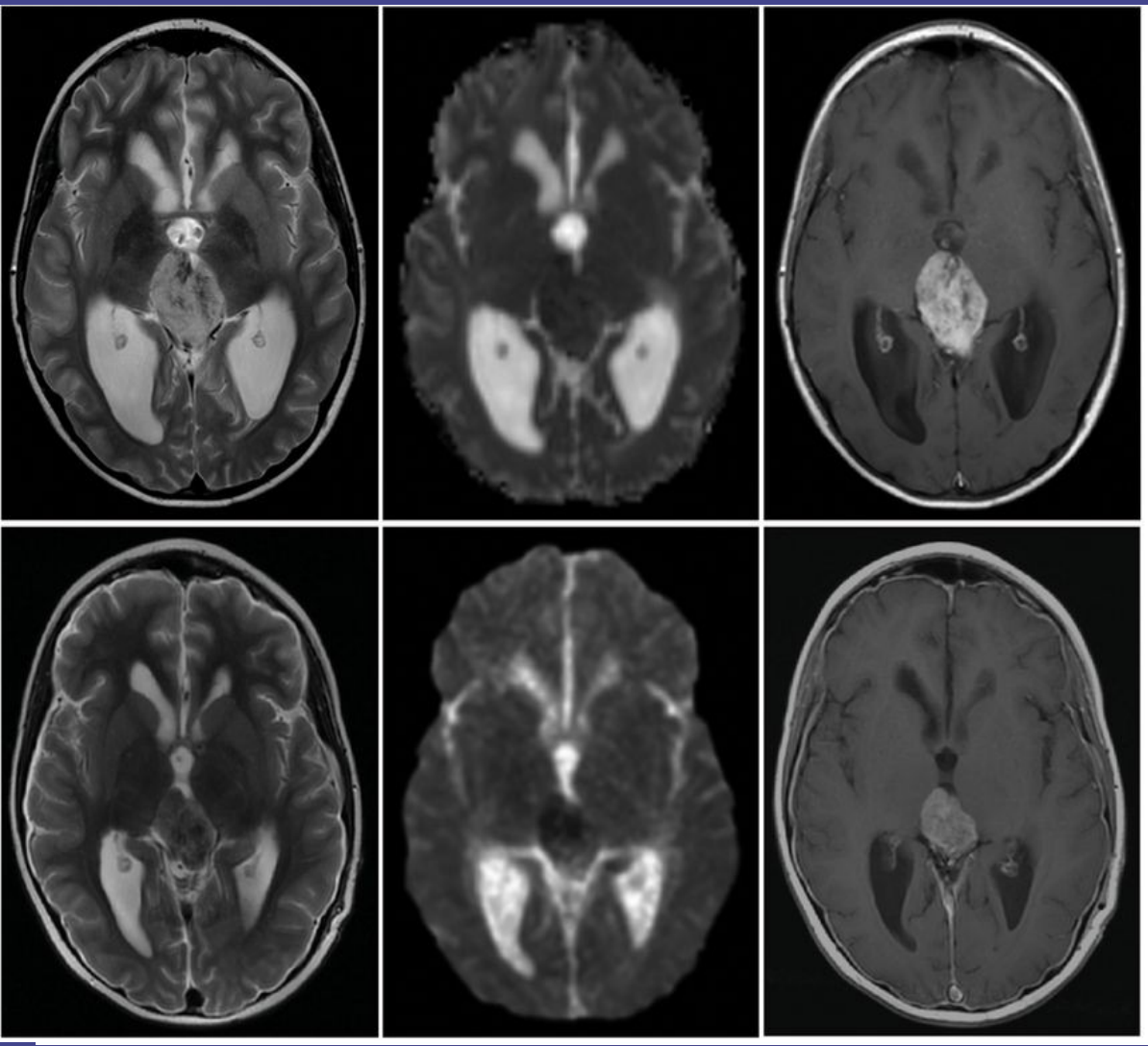


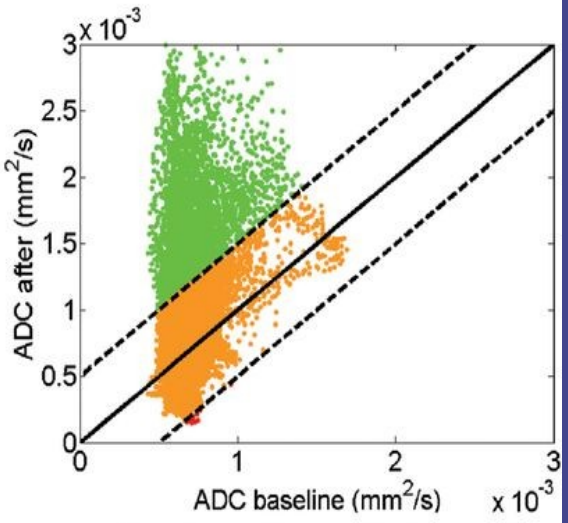


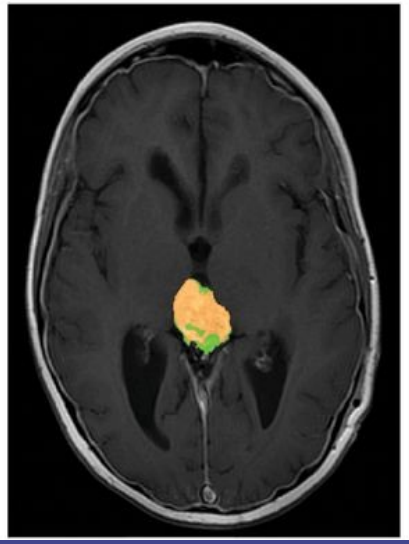


Follow-up

A ROI or the whole tumor?

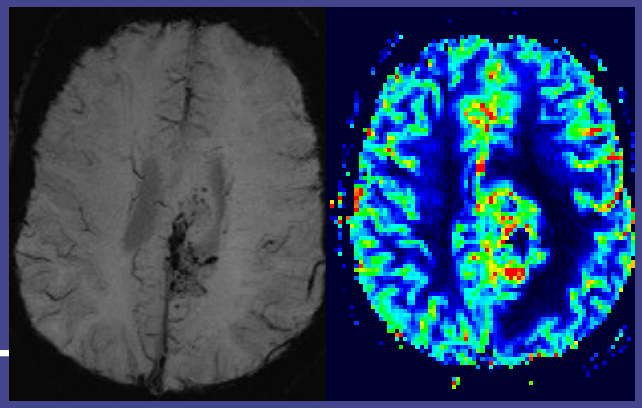






Br J Radiol 2012;85:e1204-e1211. Neuro Oncol 2013;15:981-989

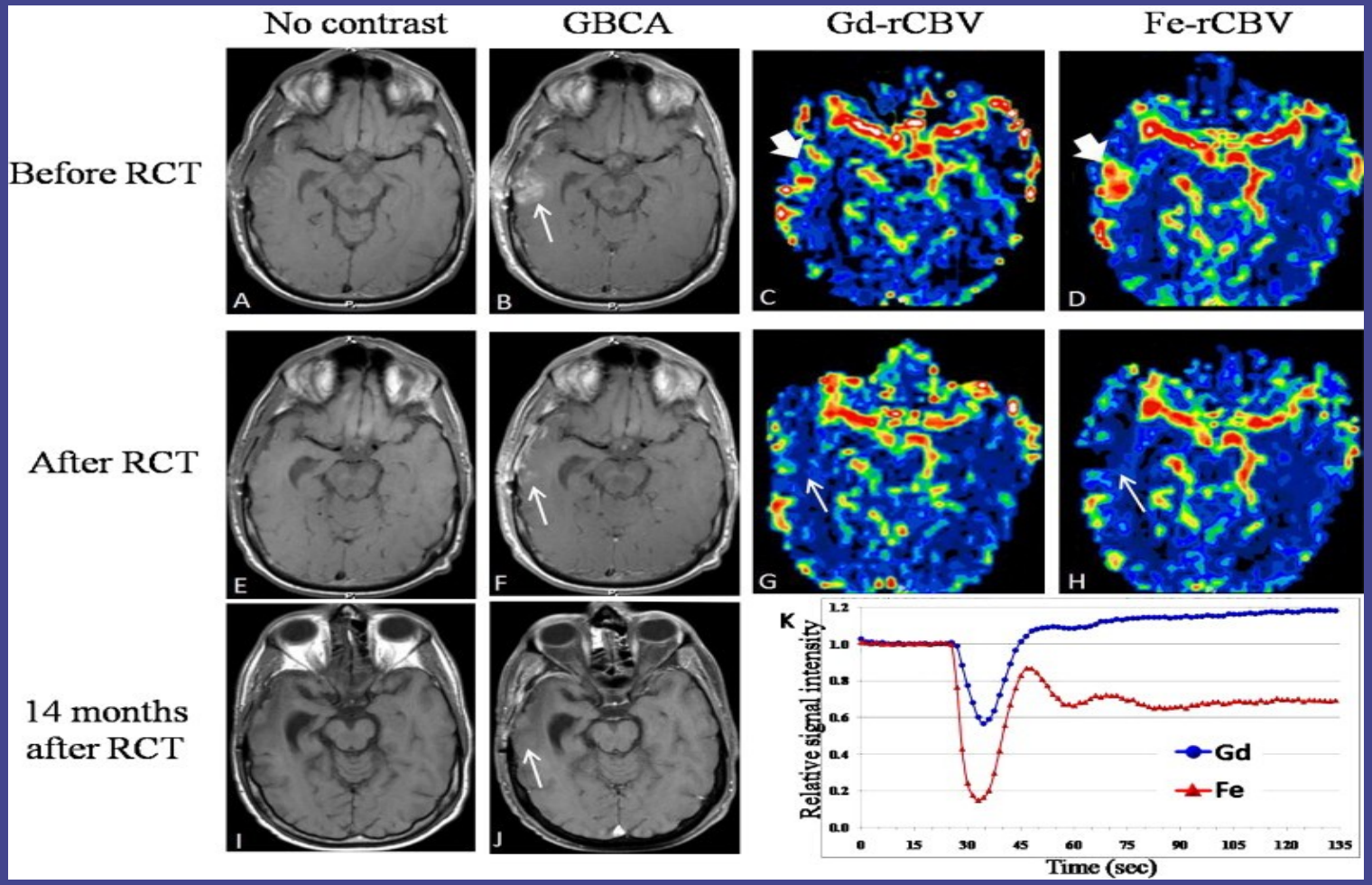
Related to other techniques



- rCBV and SWI
- DCE grading better than 3D arterial spin labeling (PCASL
- Recurrence PET:moderate accuracy
  - ^{18}F-FDG and ^{11}C-MET

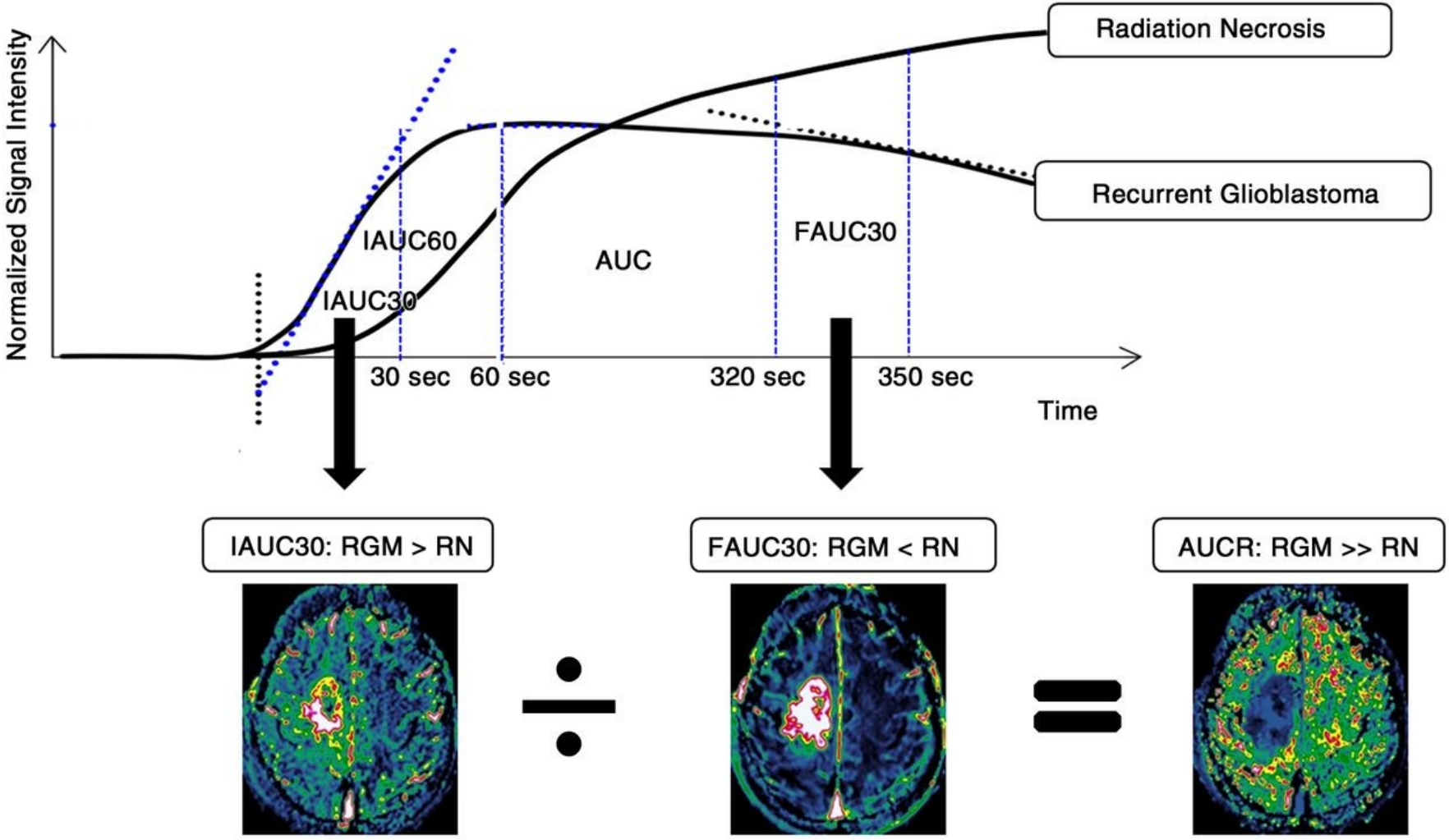
Am. J. Neuroradiol. 2013 34:944-950
J Comput Assist Tomogr 2013;37: 321-326

Hope:ferumoxytol (ferumoxitol)



Potential for Differentiation of Pseudoprogression From True Tumor Progression With Dynamic Susceptibility-Weighted Contrast-Enhanced Magnetic Resonance Imaging Using Ferumoxytol vs. Gadoteridol: A Pilot Study
Int J Rad Oncol Biol Phys 2011;79:514 - 523

DCE T1
Not comparable

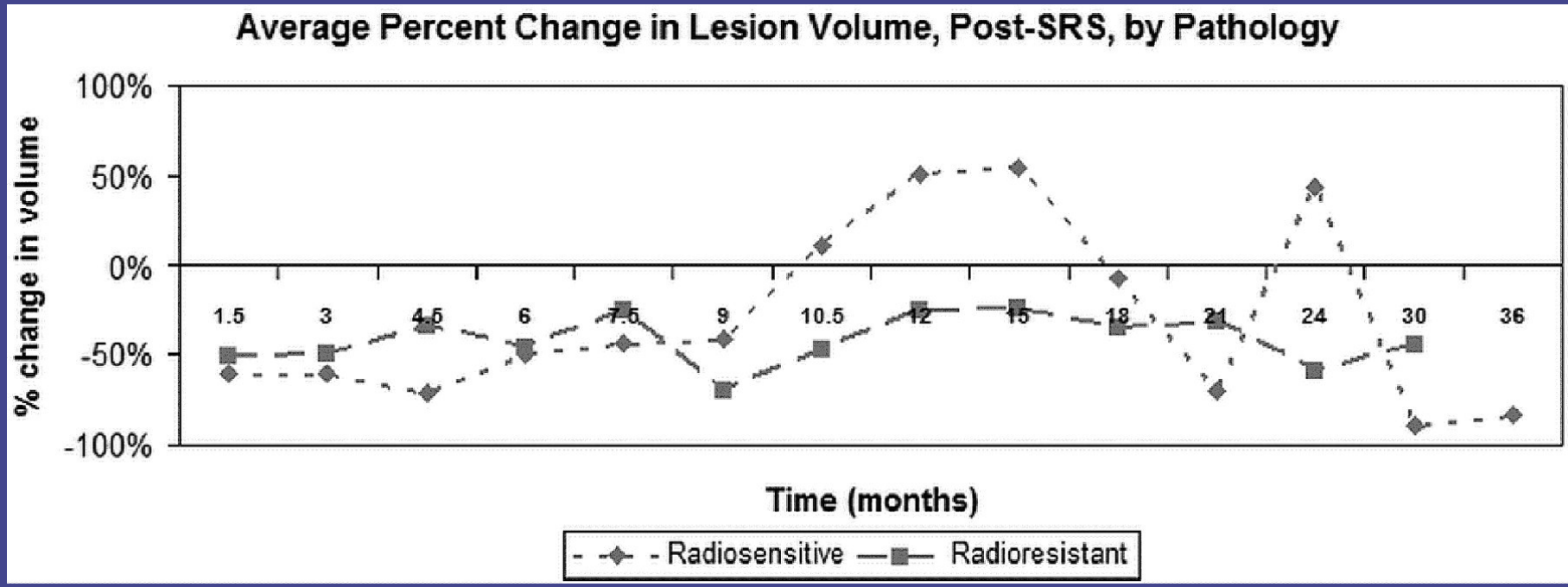


Radiology 2013 doi:10.1148/radiol.13130016 Published online July 22, 2013,

Metastases post-SRS

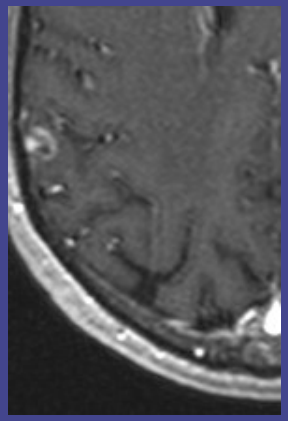
- Most metastatic lesions are stable or smaller in size during the first 12 months.
- Transient ↑ volume in 33% of lesions.
- Sex, treatment dose, initial lesion size, and histopathology correlate with variations in volume .
- The longer survival, the more likely an increase in lesion size will be seen on follow-up imaging.

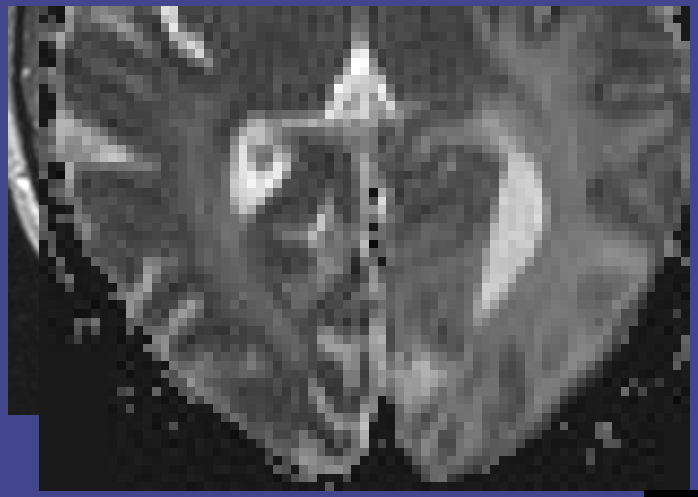
Evolution after radiosurgery

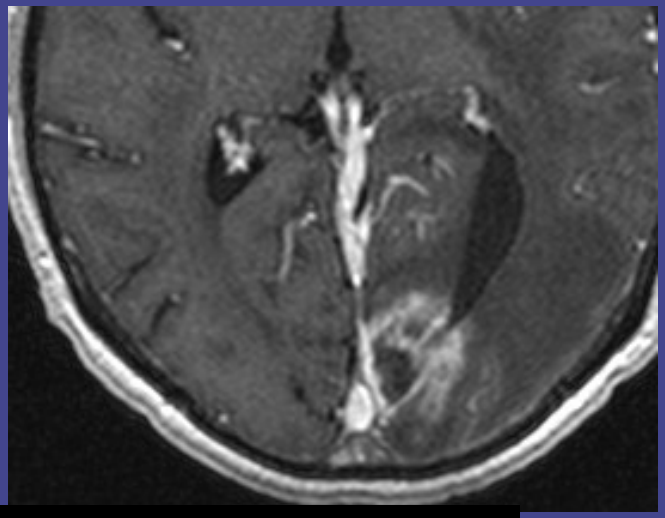


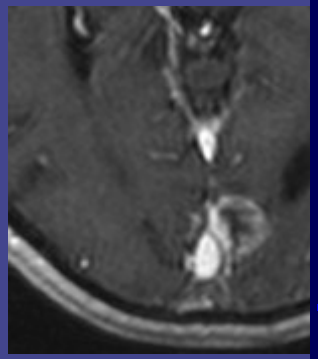
- 33% ↑ due to radiation necrosis
- Keep alert!

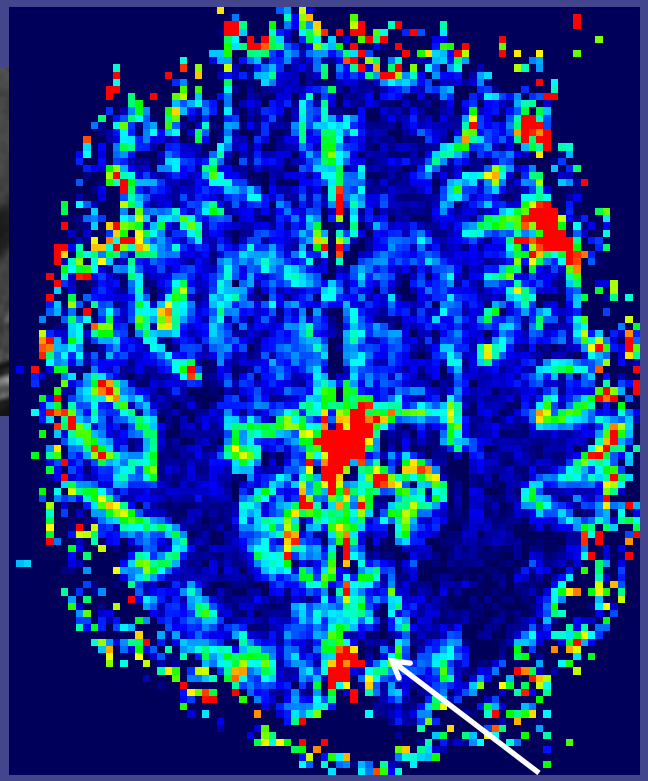
AJNR Am J Neuroradiol 2011;32:1885-1892

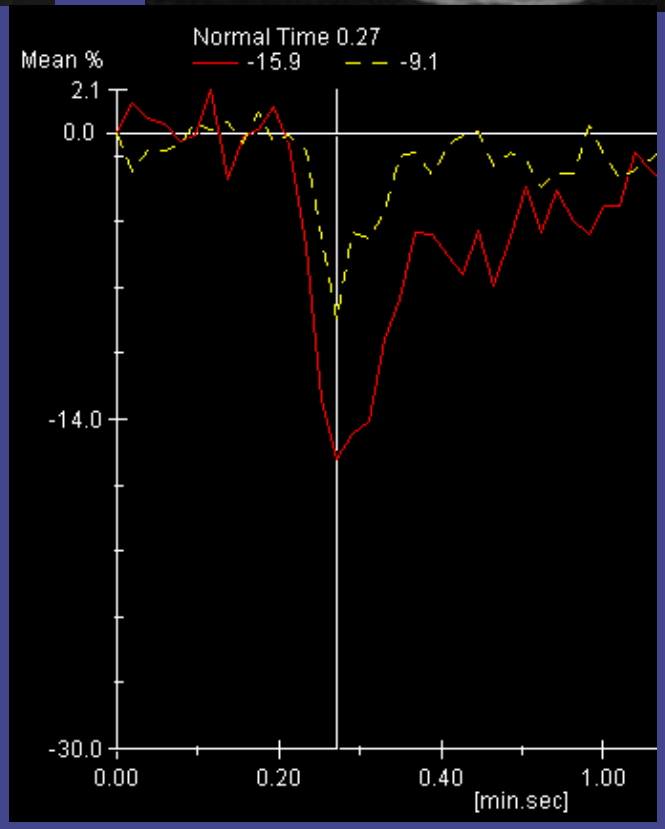











Normal Time 0.27
Mean %
-15.9
-9.1
2.1
0.0
-14.0
-30.0
0.00
0.20
0.40
1.00
[min.sec]

rCBV 1.7

Radiation necrosis

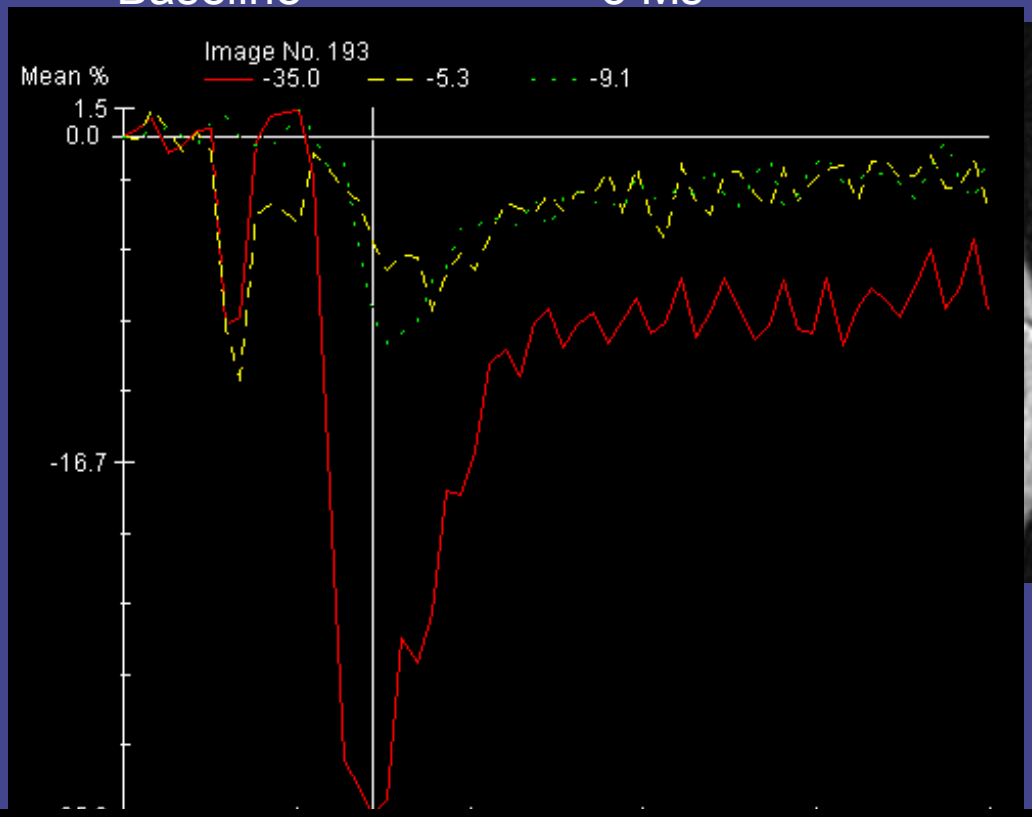
- Not all-or-nothing phenomenon
- Forget T1/T2 mismatch, etc
- Cutoff rCBV <2.1:
  - sensitivity 100%
  - specificity 95.2%

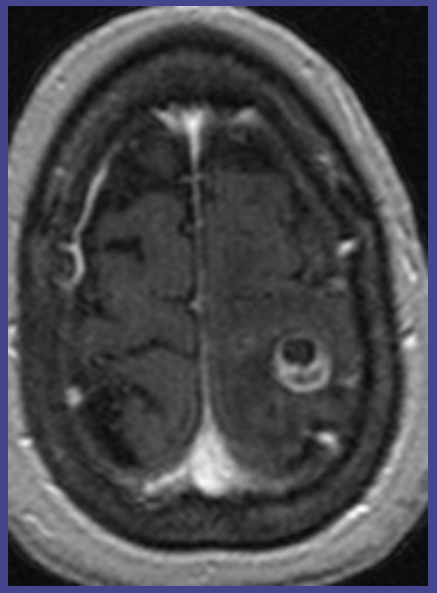
J Neurooncol 2010;99:81–88

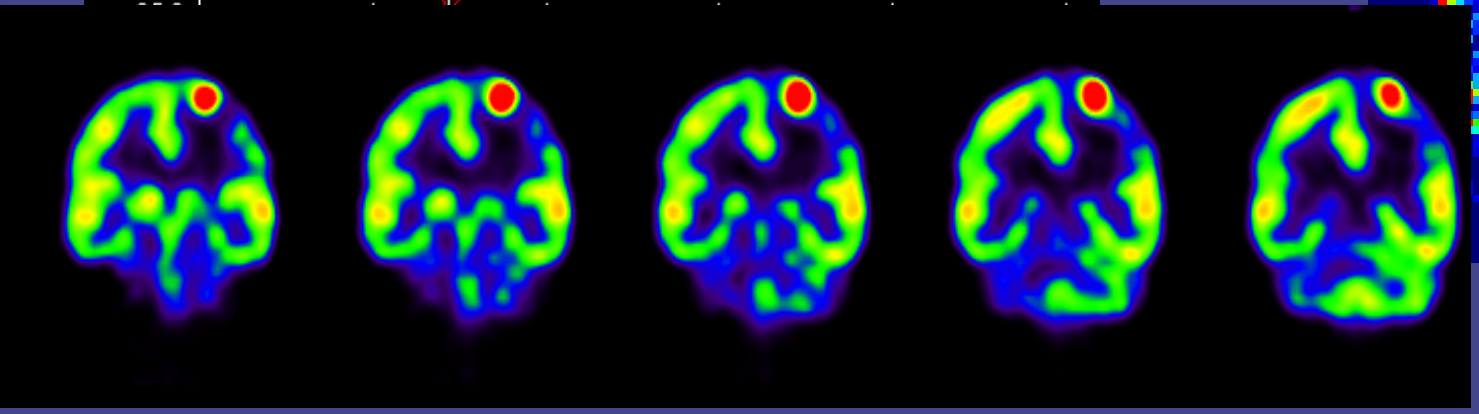
Baseline

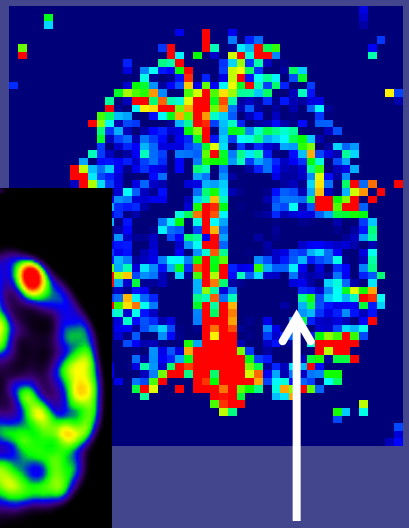
3 Ms

9 Ms

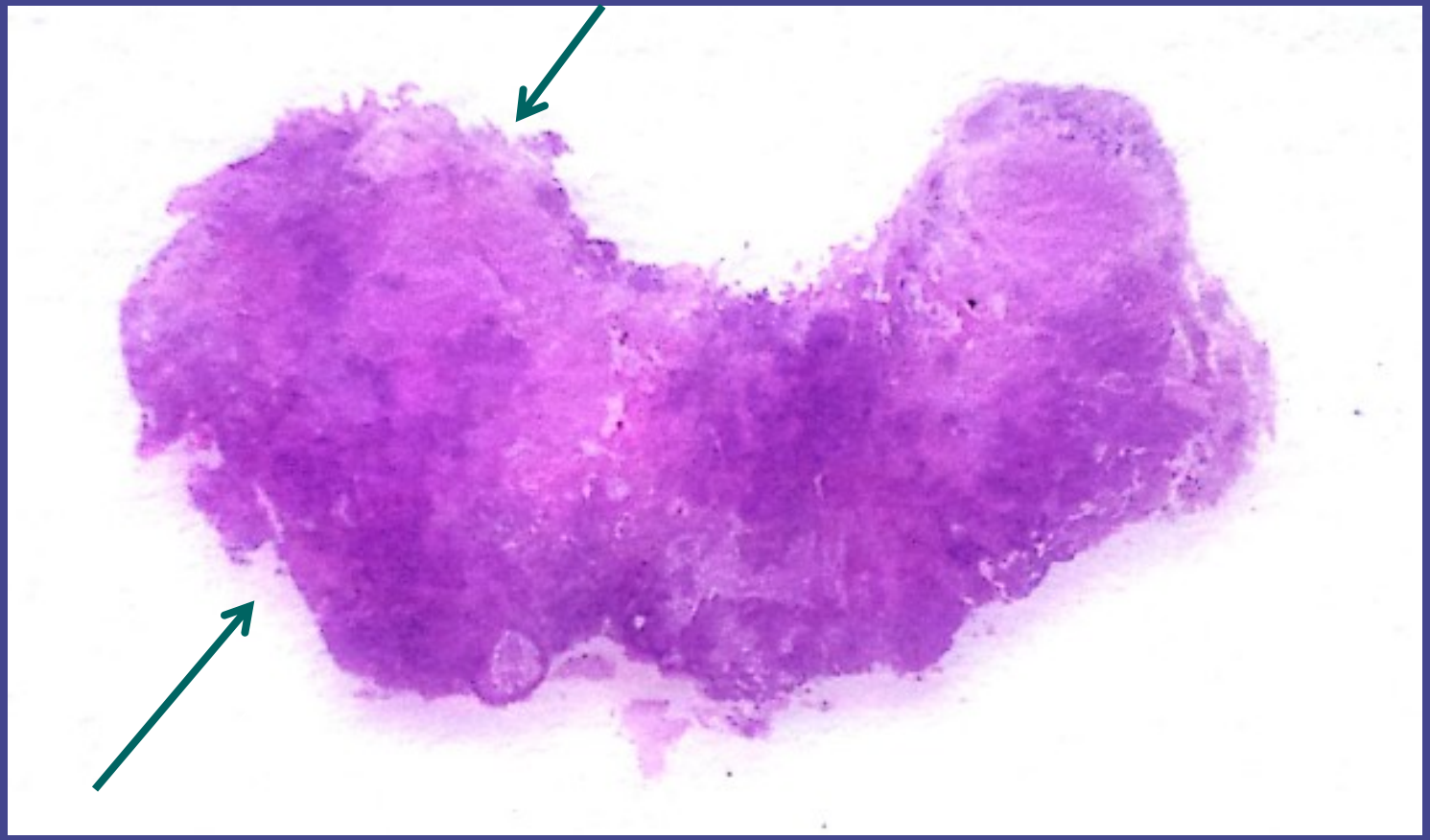






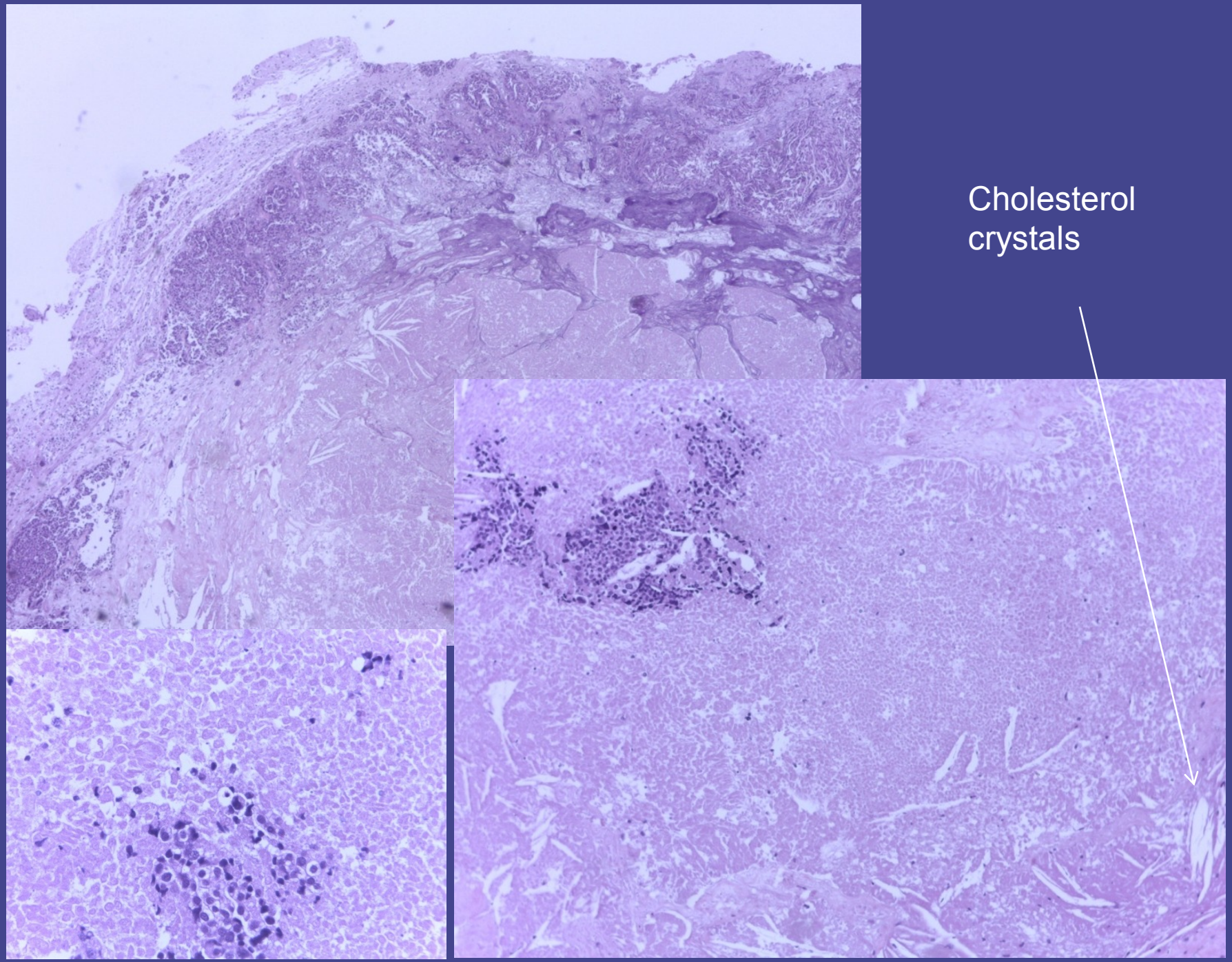


Necrosis



Tumor

Courtesy Dra. J Cruz


Cholesterol
crystals

Key points

- Protocol and baseline
- Therapy, beware antiangiogenic!
- MGMT
  - methylated: give a chance to PSP
  - unmethylated
- Poor prognosis rCBV>2.3
- Mets vs RDN rCBV>2.1

AllTrials campaign

THE PROBLEM

Thousands of clinical trials have not reported results.

Information on what was done and what was found in these trials could be lost forever to doctors and researchers, leading to bad treatment decisions, missed opportunities for good medicine, and trials needlessly repeated.

WHAT CAN YOU DO?

- Join the 58,000 individuals who have signed the petition for all clinical trials to be registered and the results reported.
- Ask your organisation to join the campaign (400+ organisations have joined so far)
- Write a feature, blog post, editorial, or tell your members in your organisation's newsletter
- Ask your friends, family, and colleagues to sign up
- Donate to the campaign
- Get involved in other ways via www.alltrials.net

All Trials Registered | All Results Reported

#AllTrials

www.alltrials.net

Espero ver-lhes em Valencia em 2015
Obrigado