

State-of-the-Art in the work-up of acute stroke

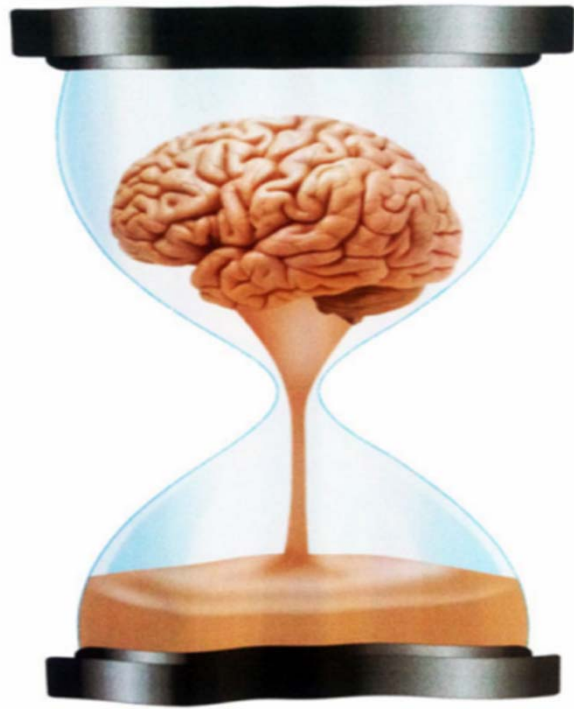
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Stroke imaging:
Basics
'mismatch' concepts
tips and tricks for daily practice



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 **UCLouvain**

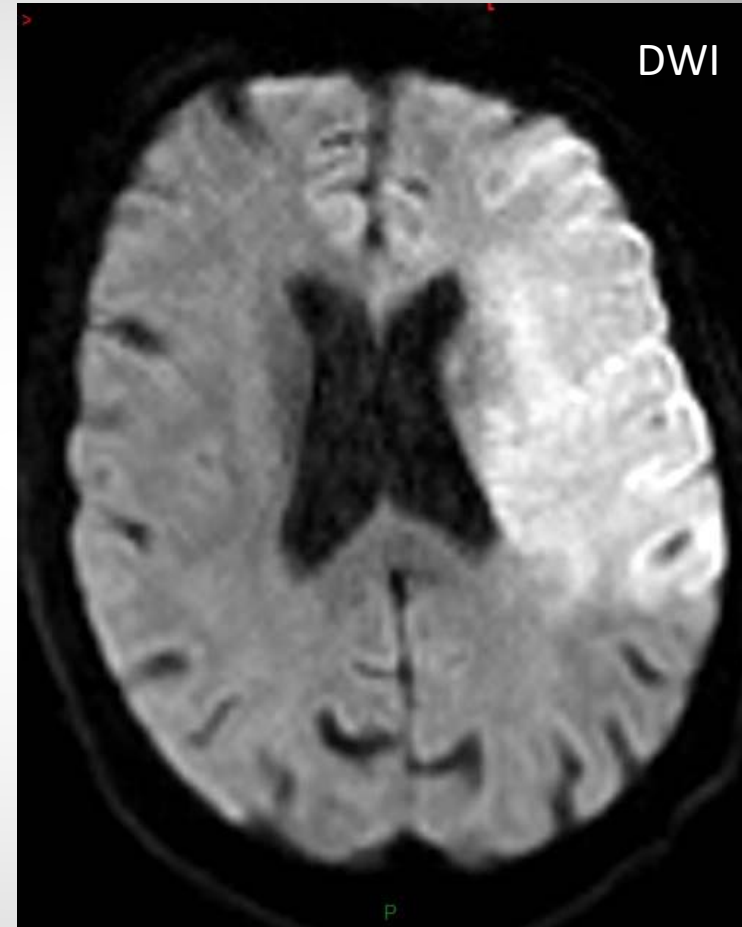
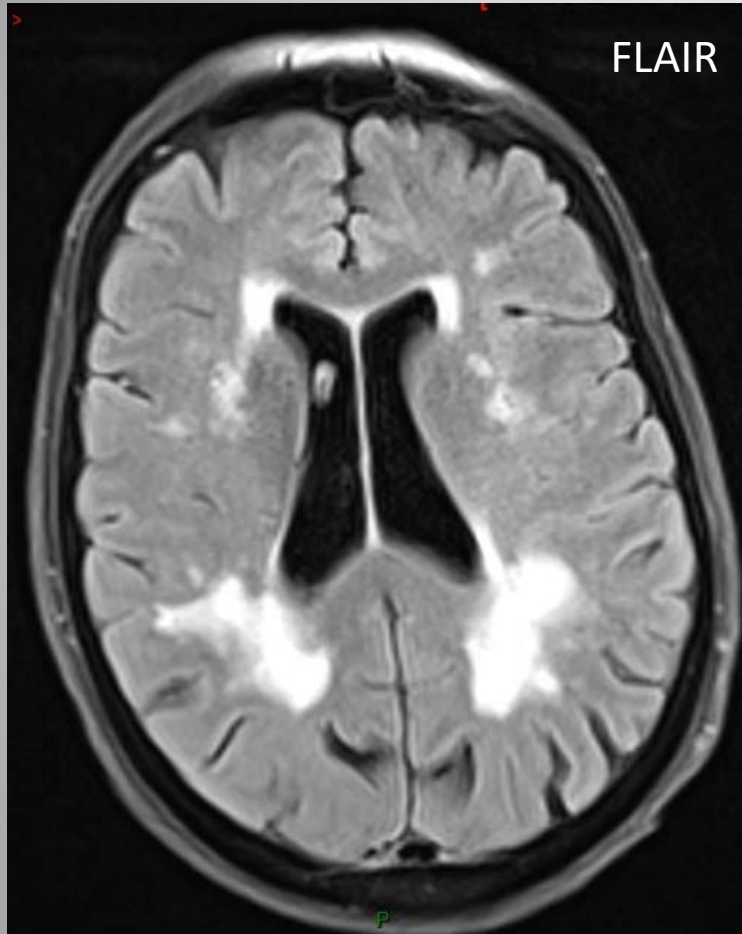


Stroke: Time is brain

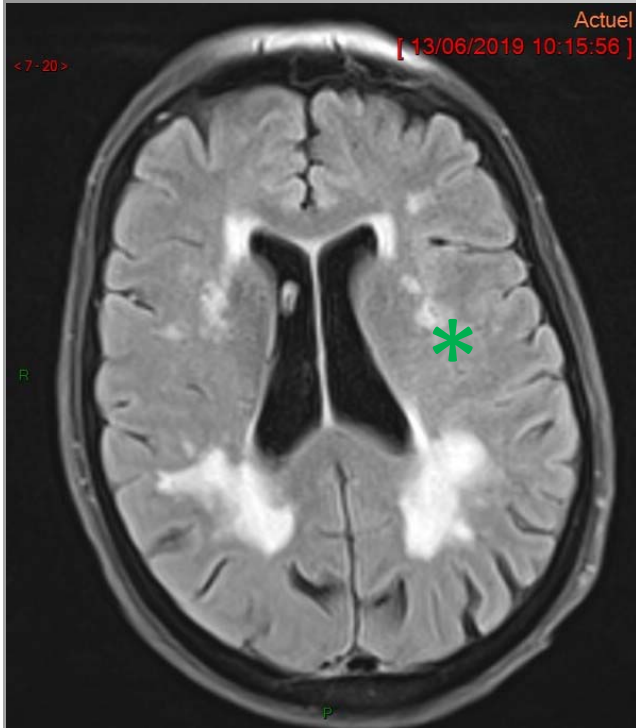
Imaging work up of acute stroke is a *race* through **mismatches**:

- mismatch type I
- mismatch type II
- mismatch type III
- mismatch type IV

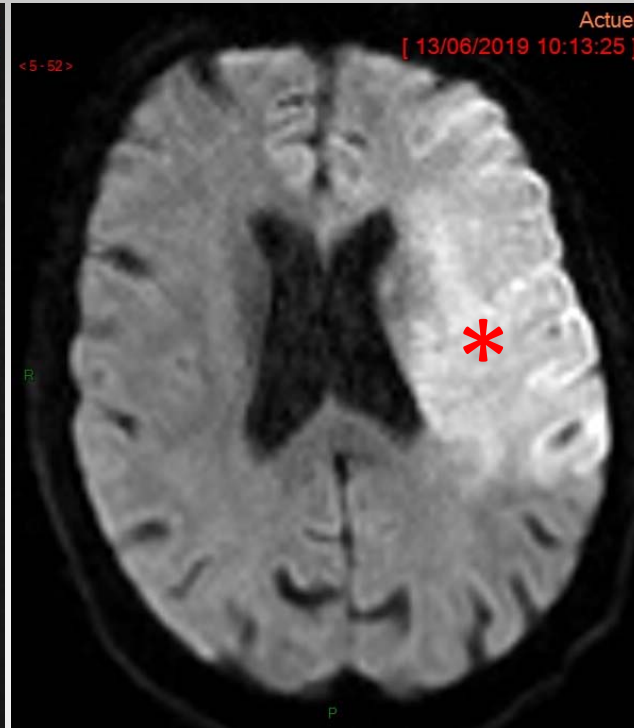
Type I mismatch



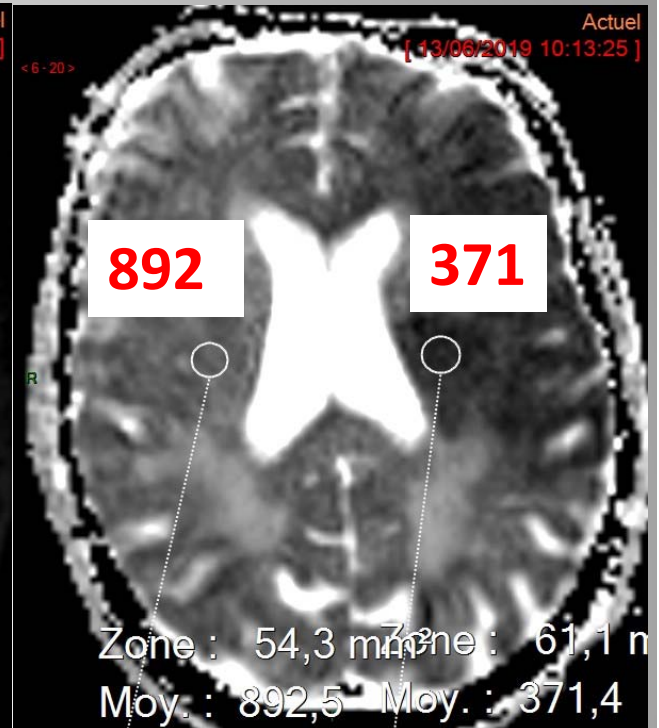
90-year-old women with aphasia and right hemiplegia on waking → 'WAKE UP' STROKE



FLAIR (-)



Diffusion-weighting (+)



DWI-ADC map (+)

1 → acute left MCA ischemic stroke *

2 → ... onseted < 4 hours *



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**Thrombolysis with Alteplase 3 to 4.5 Hours
after Acute Ischemic Stroke**

Werner Hacke, M.D., Markku Kaste, M.D., Erich Bluhmki, Ph.D., Miroslav Brozman, M.D., Antoni Dávalos, M.D.,
Donata Guidetti, M.D., Vincent Larrue, M.D., Kennedy R. Lees, M.D., Zakaria Medeghri, M.D.,
Thomas Machnig, M.D., Dietmar Schneider, M.D., Rüdiger von Kummer, M.D., Nils Wahlgren, M.D.,
and Danilo Toni, M.D., for the ECASS Investigators*

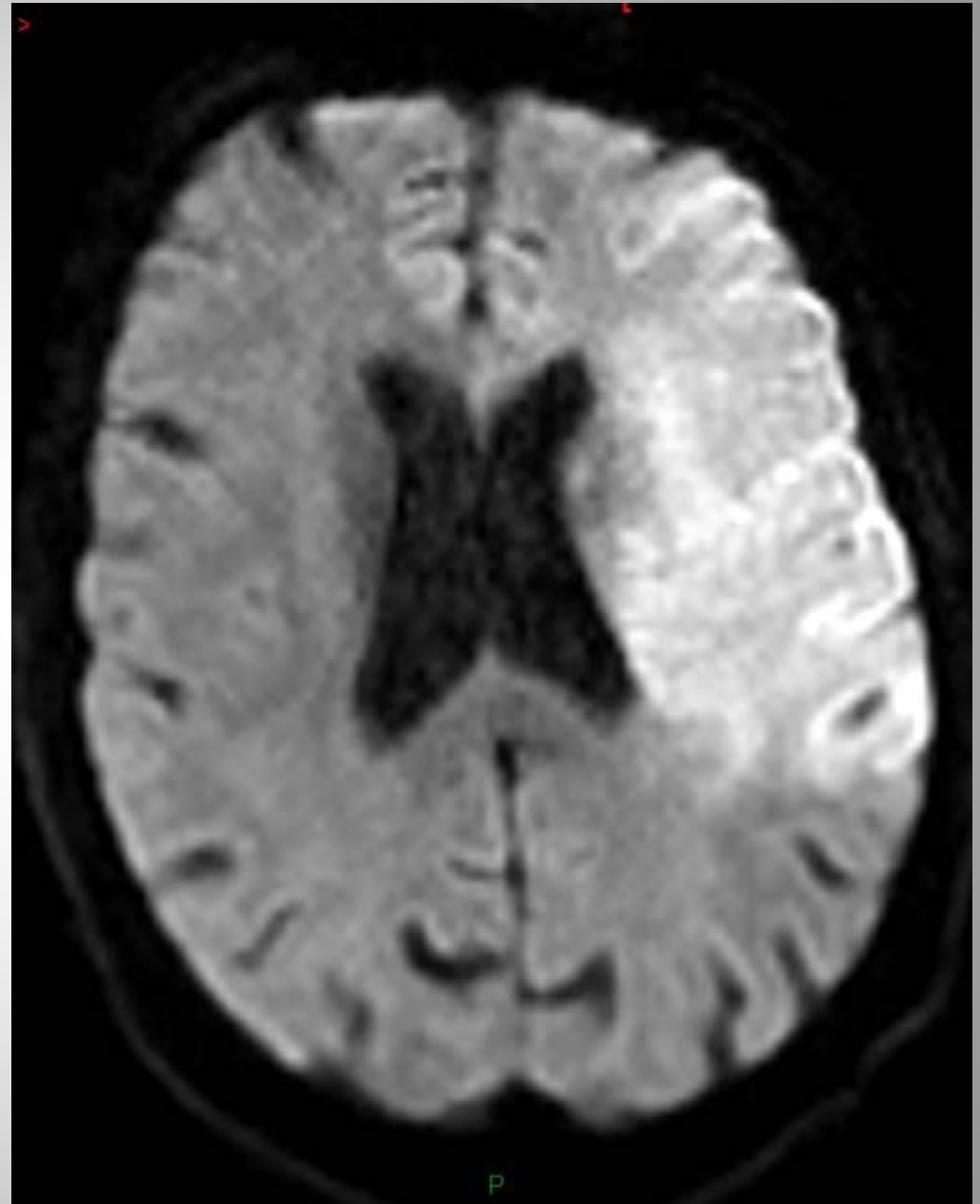


Semiologic tip 1

MR diffusion-weighted imaging (DWI) is the most sensitive imaging modality for positive diagnosis at earliest phase (**20 min**) of acute stroke



CT(+): 3-4 hours
FLAIR (+): ~ 4 hours
FSE T2 (+): ~ 6 hours



ORIGINAL ARTICLE

MRI-Guided Thrombolysis for Stroke with Unknown Time of Onset

G. Thomalla, C.Z. Simonsen, F. Boutitie, G. Andersen, Y. Berthezene, B. Cheng, B. Cheripelli, T.-H. Cho, F. Fazekas, J. Fiehler, I. Ford, I. Galinovic, S. Gellissen, A. Golsari, J. Gregori, M. Günther, J. Guibernau, K.G. Häusler, M. Hennerici, A. Kemmling, J. Marstrand, B. Modrau, L. Neeb, N. Perez de la Ossa, J. Puig, P. Ringleb, P. Roy, E. Scheel, W. Schonewille, J. Serena, S. Sunaert, K. Villringer, A. Wouters, V. Thijs, M. Ebinger, M. Endres, J.B. Fiebach, R. Lemmens, K.W. Muir, N. Nighoghossian, S. Pedraza, and C. Gerloff, for the WAKE-UP Investigators*

Patients having (-) FLAIR and (+) DWI fall into the time delay for IV thrombolytic therapy set at 4h30



Concept tip 1

YES

Eligible for IV thrombolysis ?

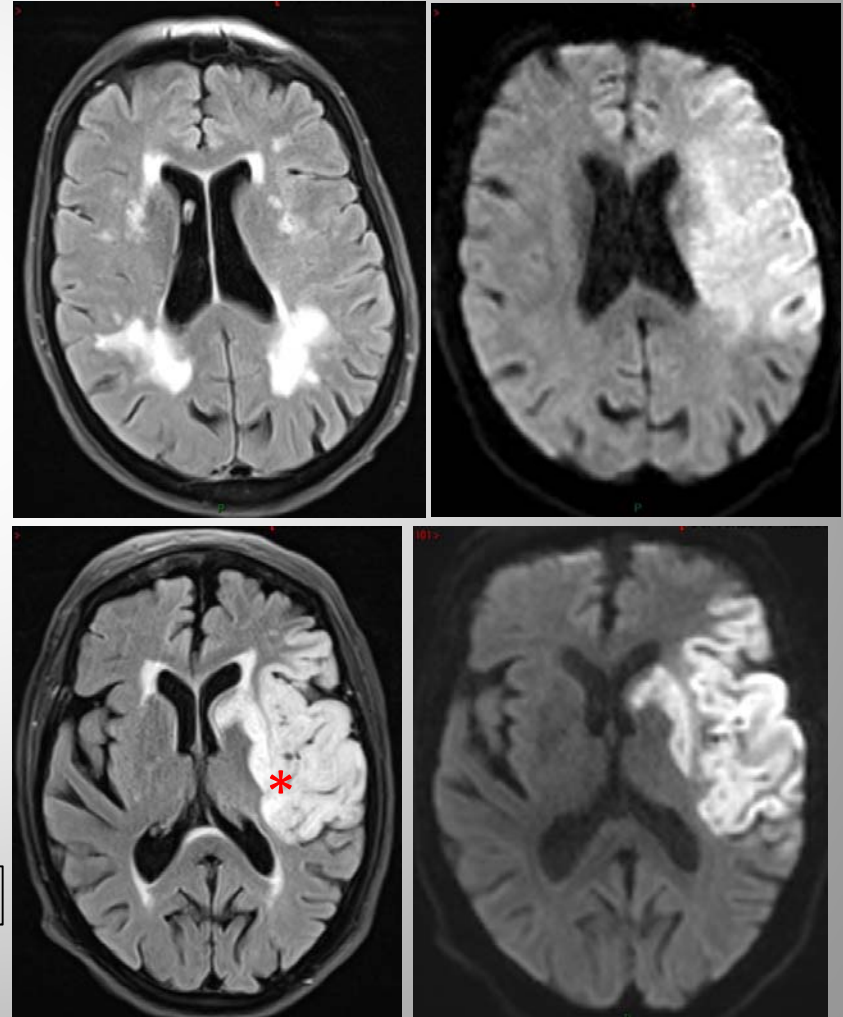
**MISMATCH TYPE 1
=
TEMPORAL MISMATCH**

NO

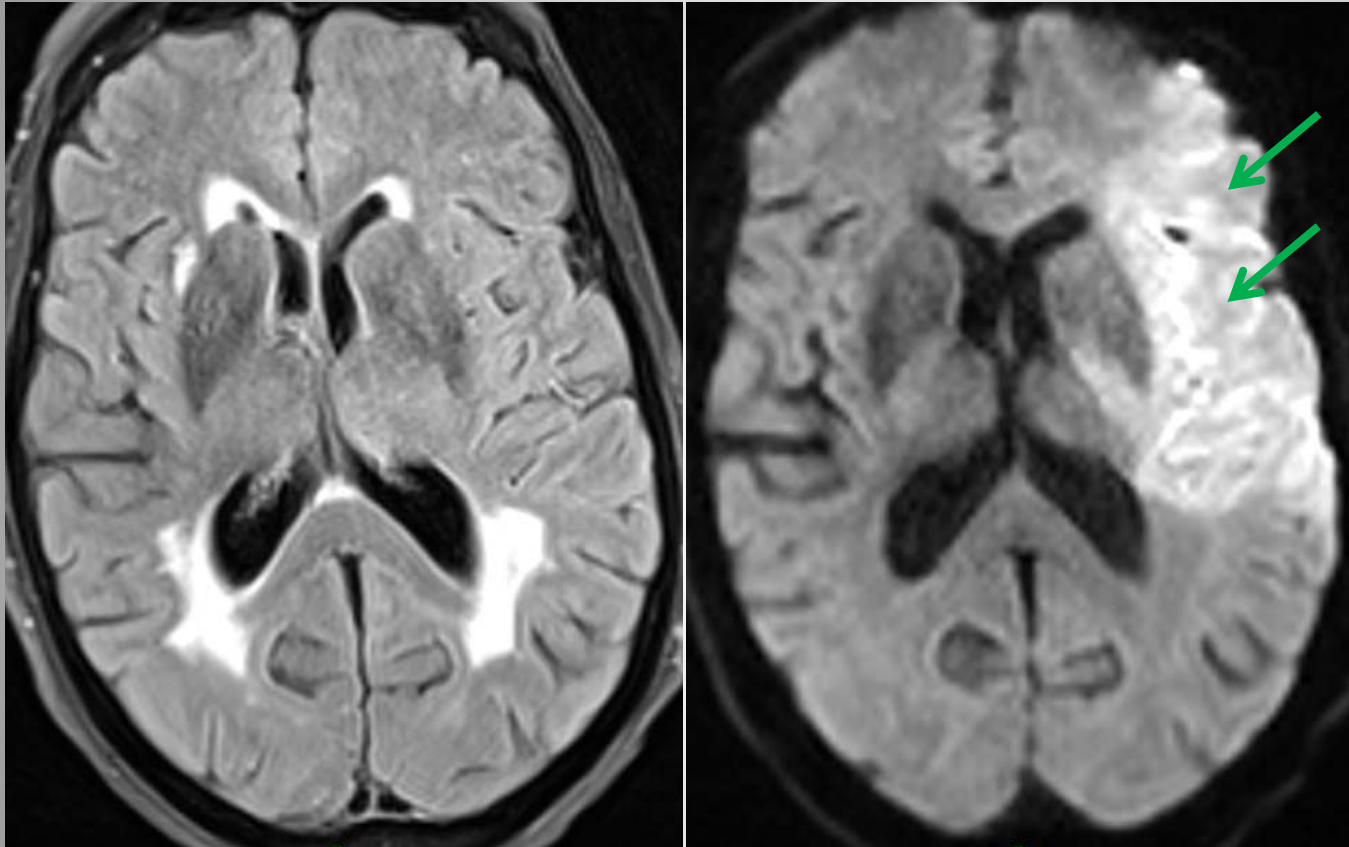


Semiologic tip 2

>6 hours infarcted tissue appears hyperintense on T2 and FLAIR images



Type II mismatch

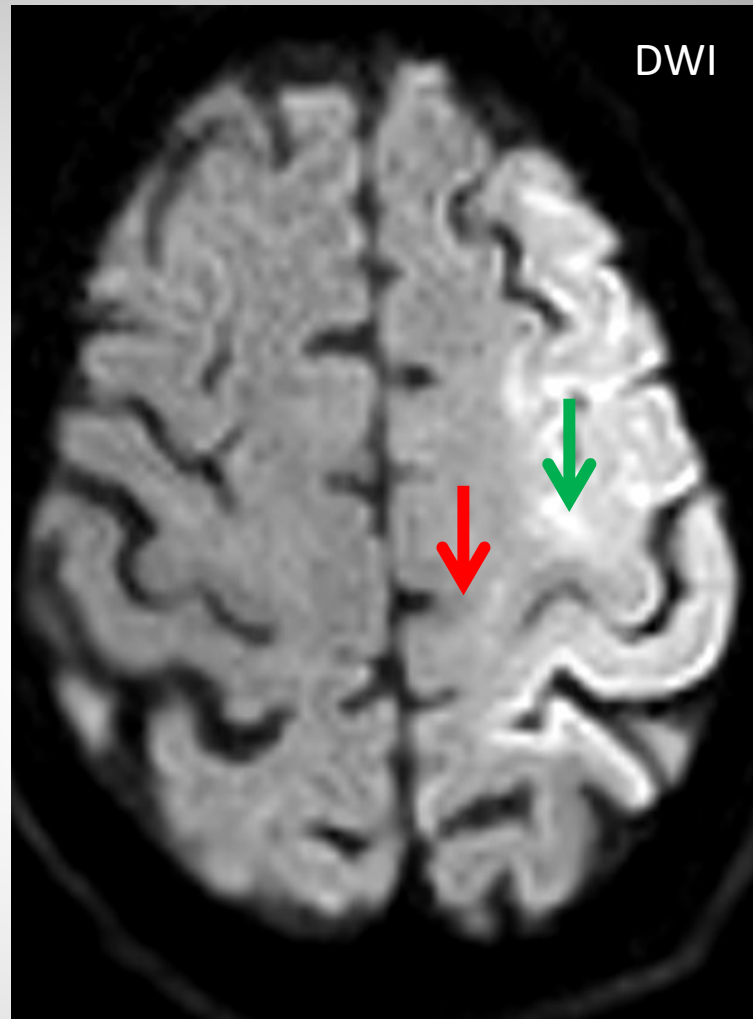
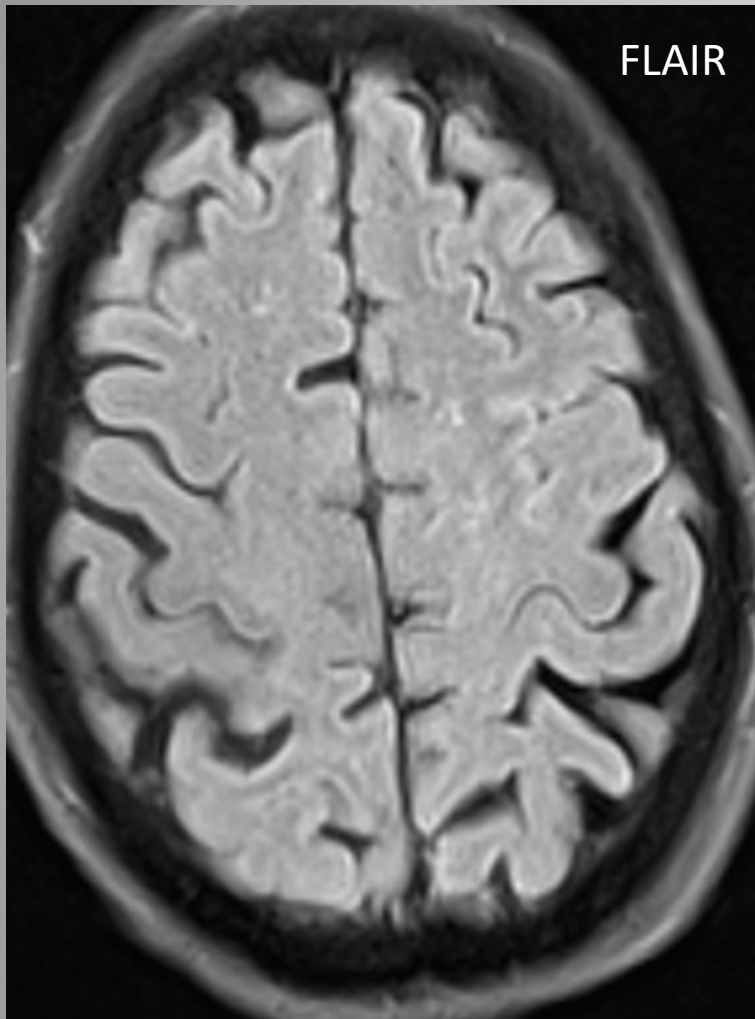


Clinically
aphasia

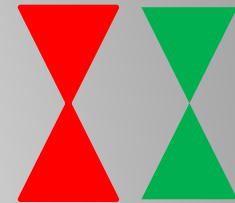


Radiologically
*infarction of the
pars triangularis
of the inferior
frontal lobe*



90-year-old woman with aphasia and right hemiplegia involving both limbs

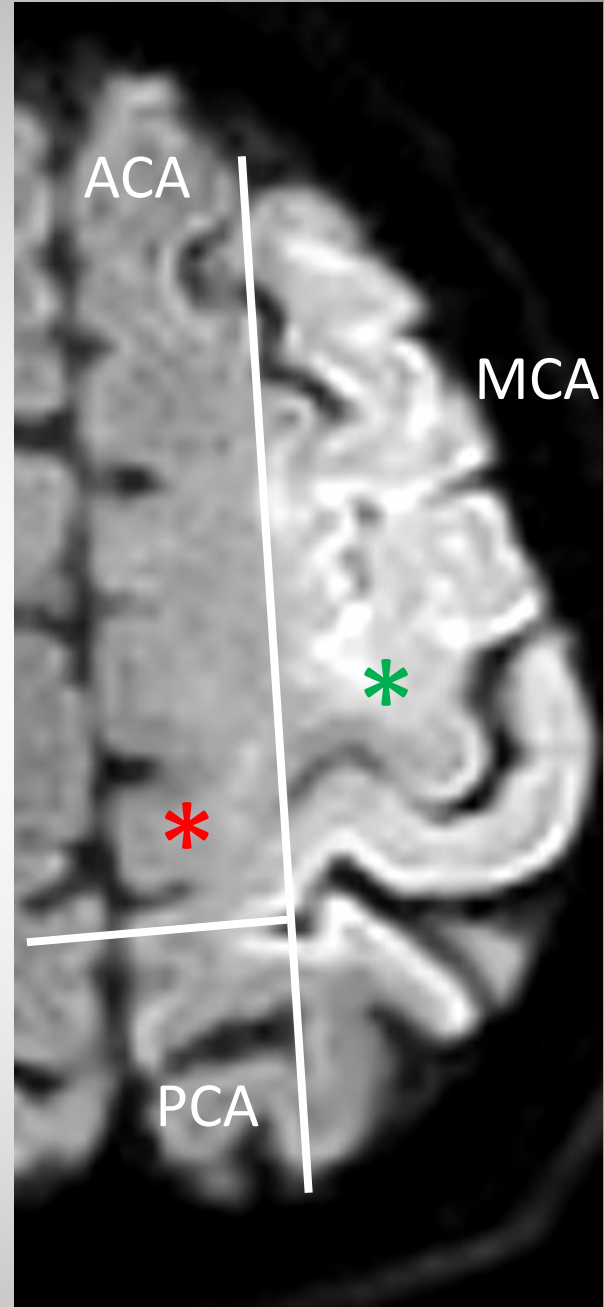
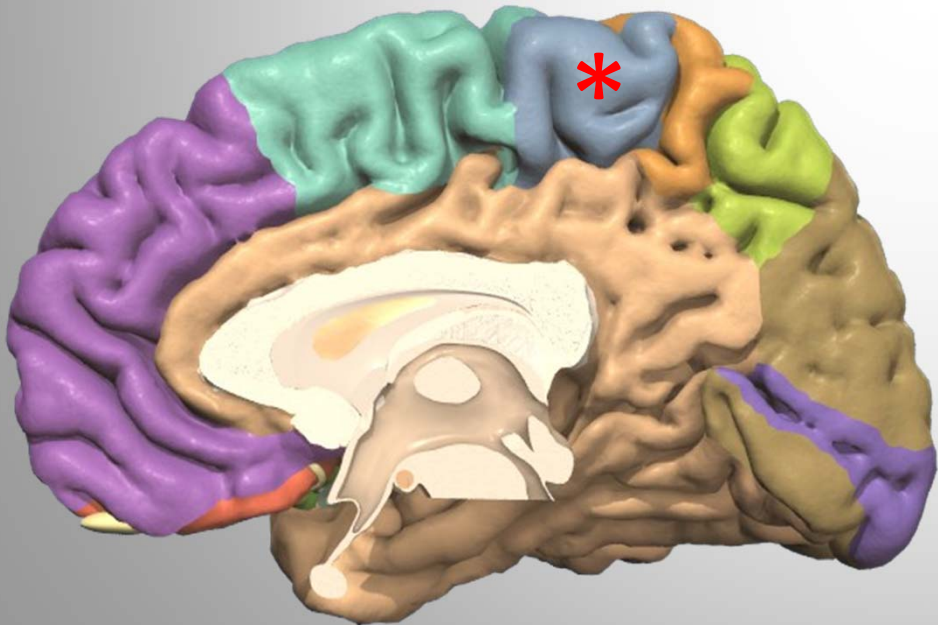
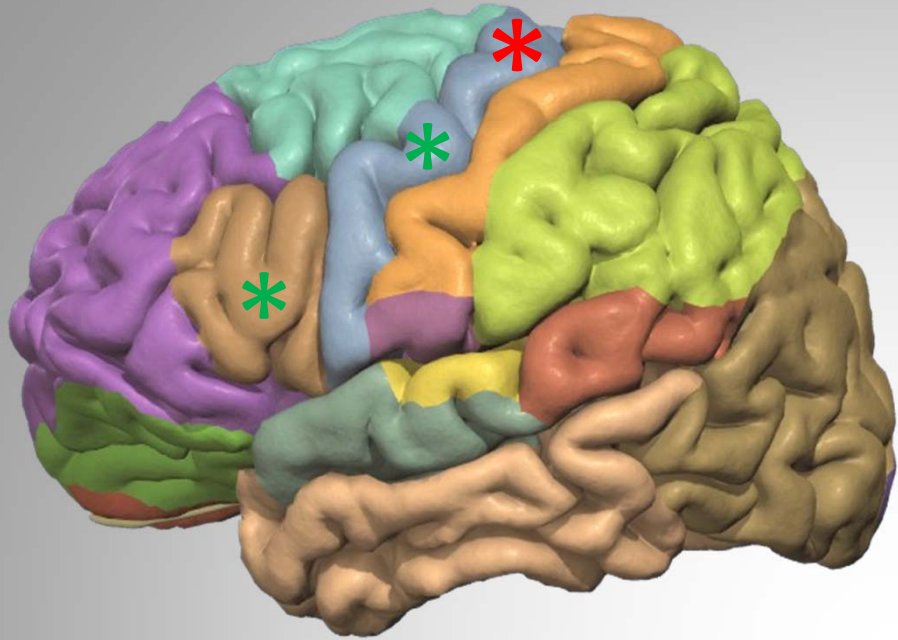


Clinically
1/2plegia



Radiologically
*Infarct of the
PMA
with 'sparing'
of the
paracentral
lobule*

 match for the upper limb
 mismatch for lower limb



I see a brain infarcted area
on DW images...
...but...
... it does **NOT** (fully) match the clinical deficit



Where/which is the missing link ?

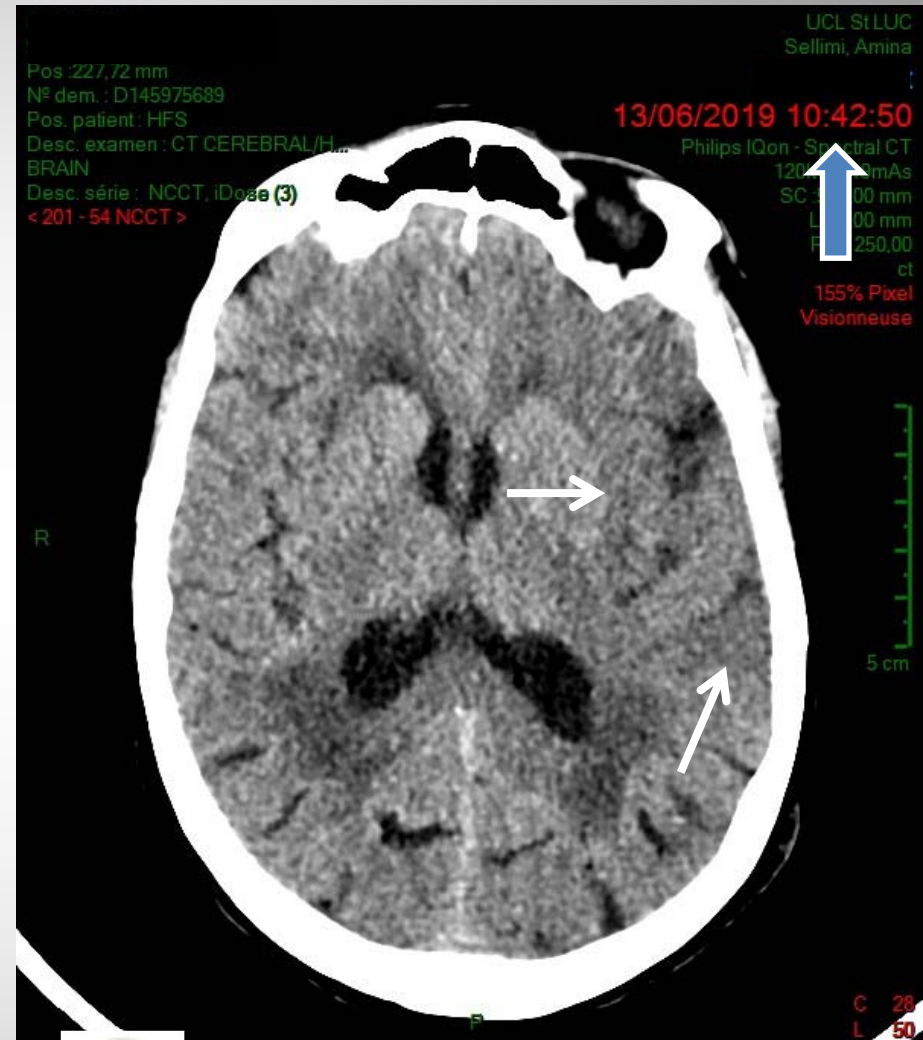
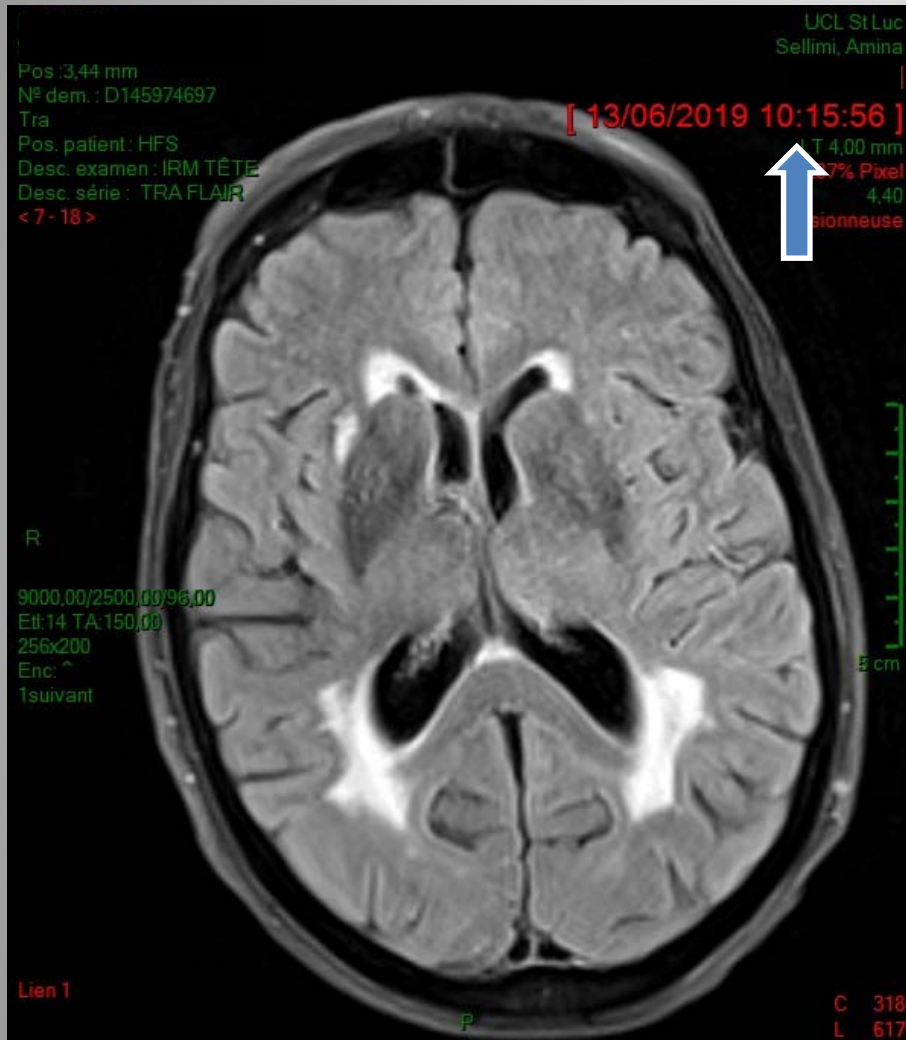


Concept tip 2



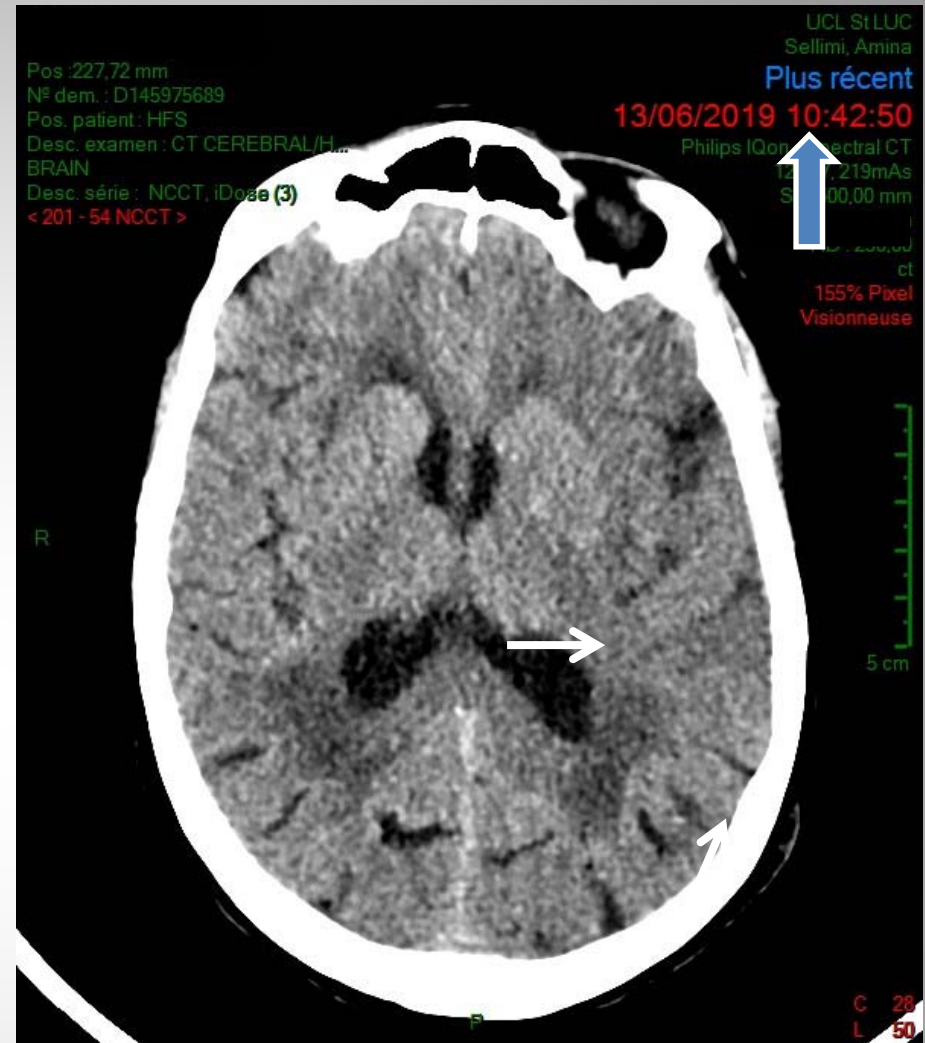
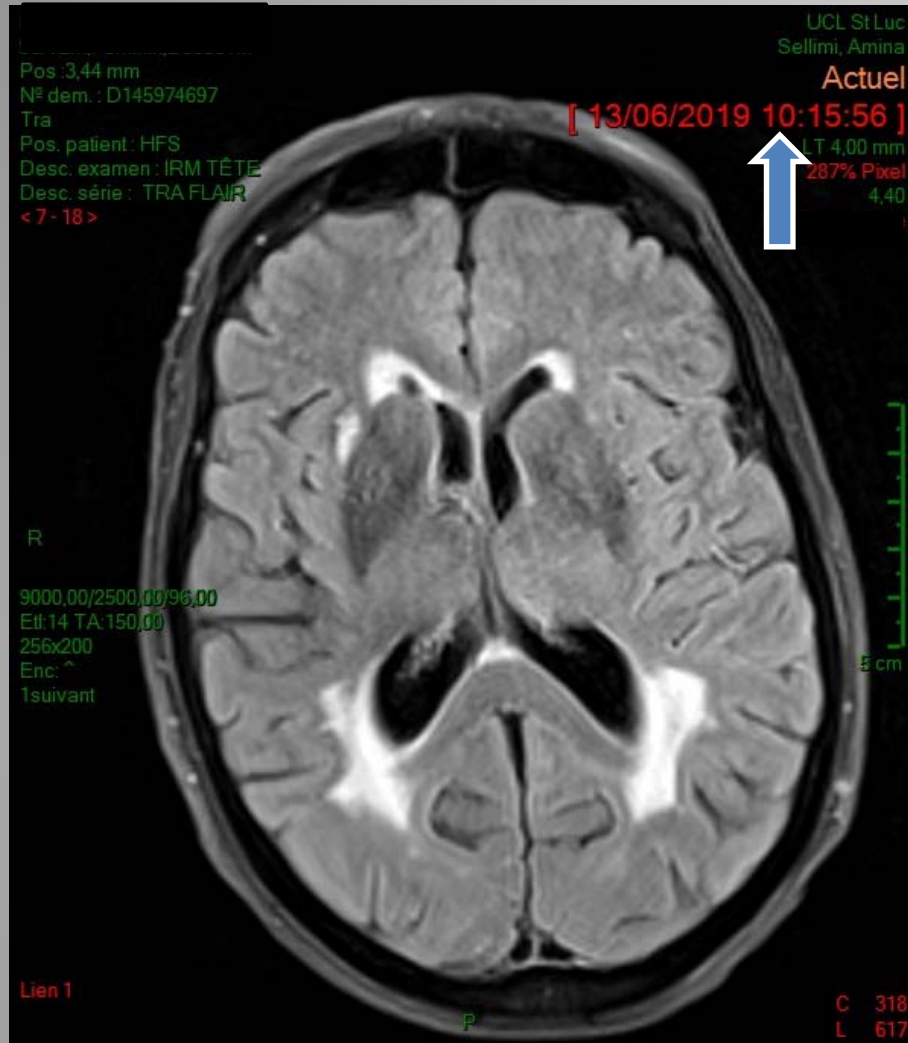
MISMATCH TYPE 2
=
CLINICAL-RADIOLOGICAL MISMATCH

90-year-old women with aphasia and right hemiplegia on waking



Semiologic tip 4

Acutely infarcted brain tissue appears hypodense on CT images




MR + CT : are you happy with that ???



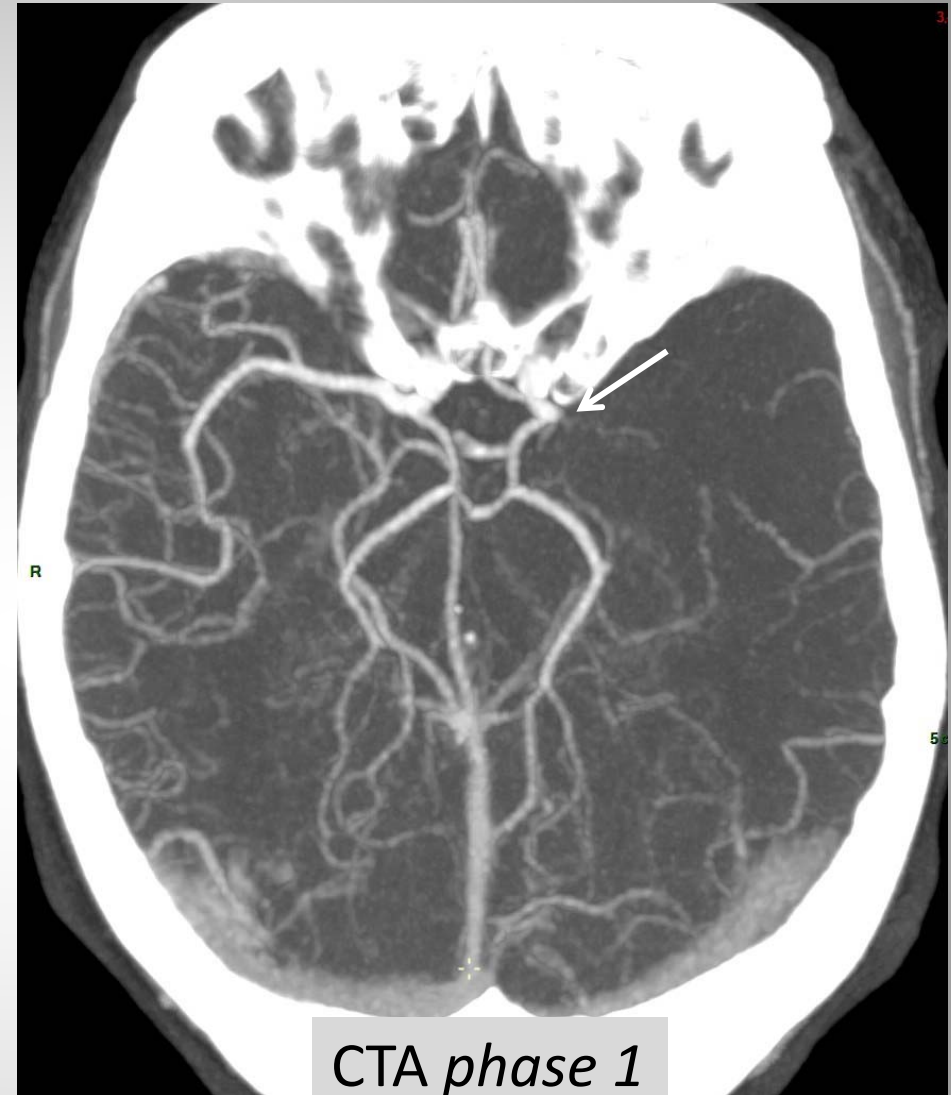
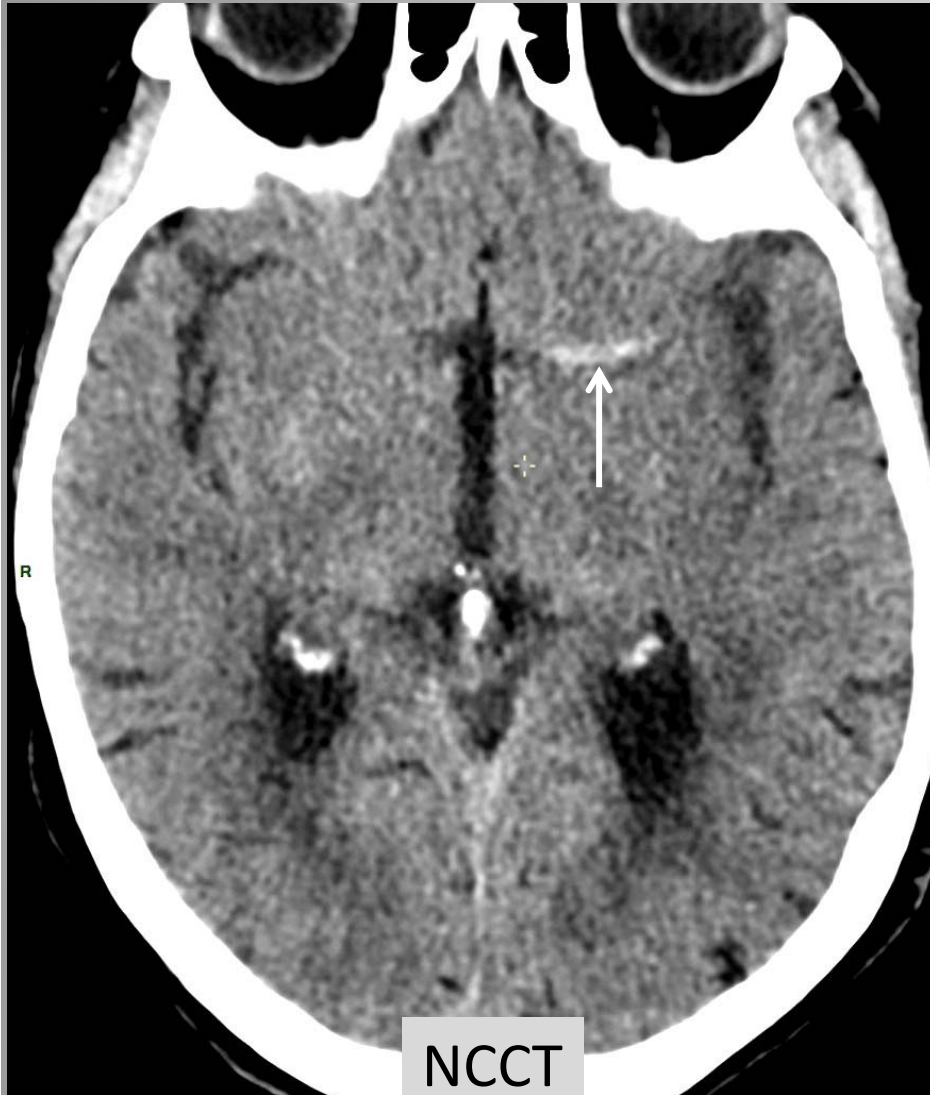
Stroke: Time is brain

NO!

Imaging requires time



imaging is brain



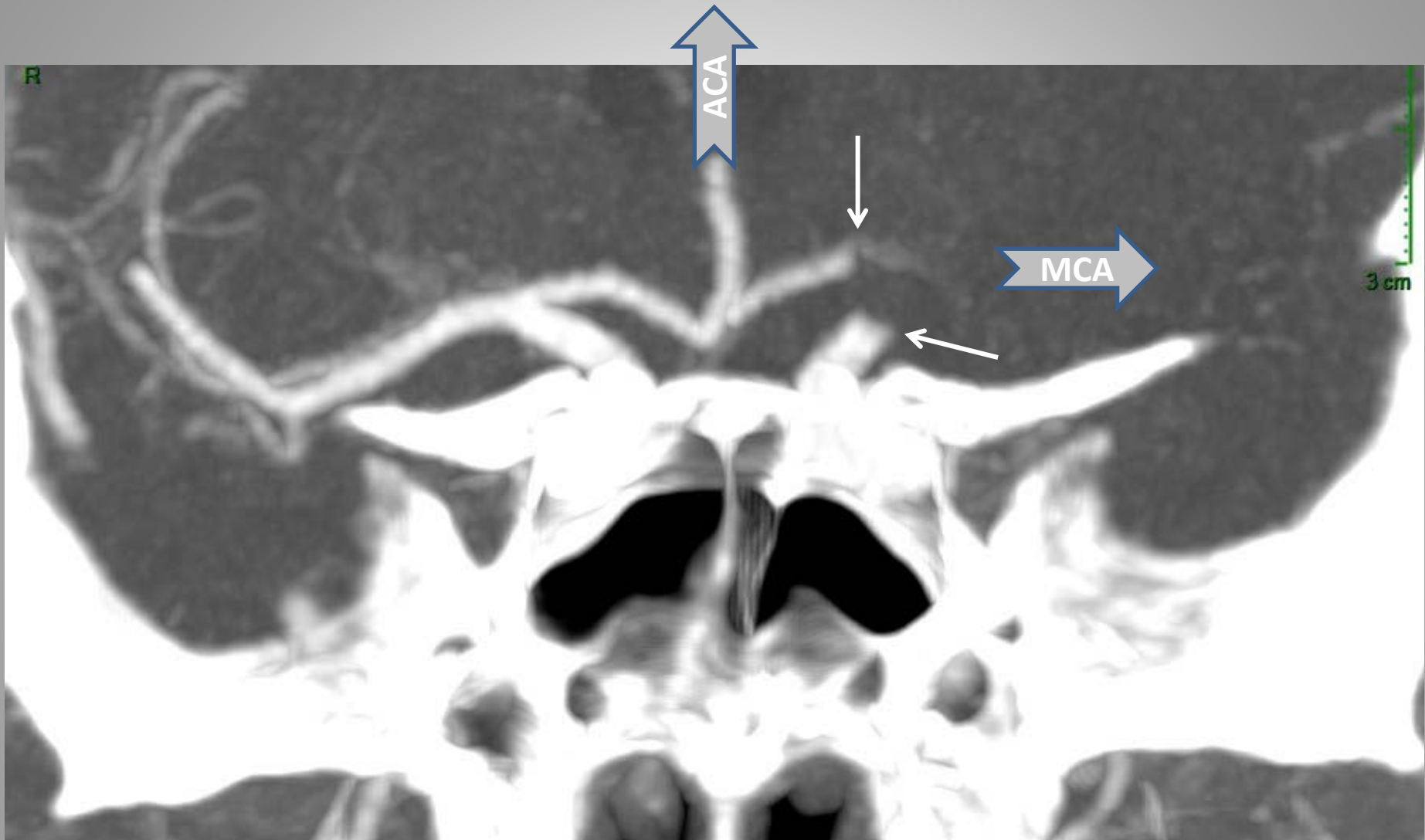
Semiologic tip 4

acute clot may be **hyperdense** on CT images

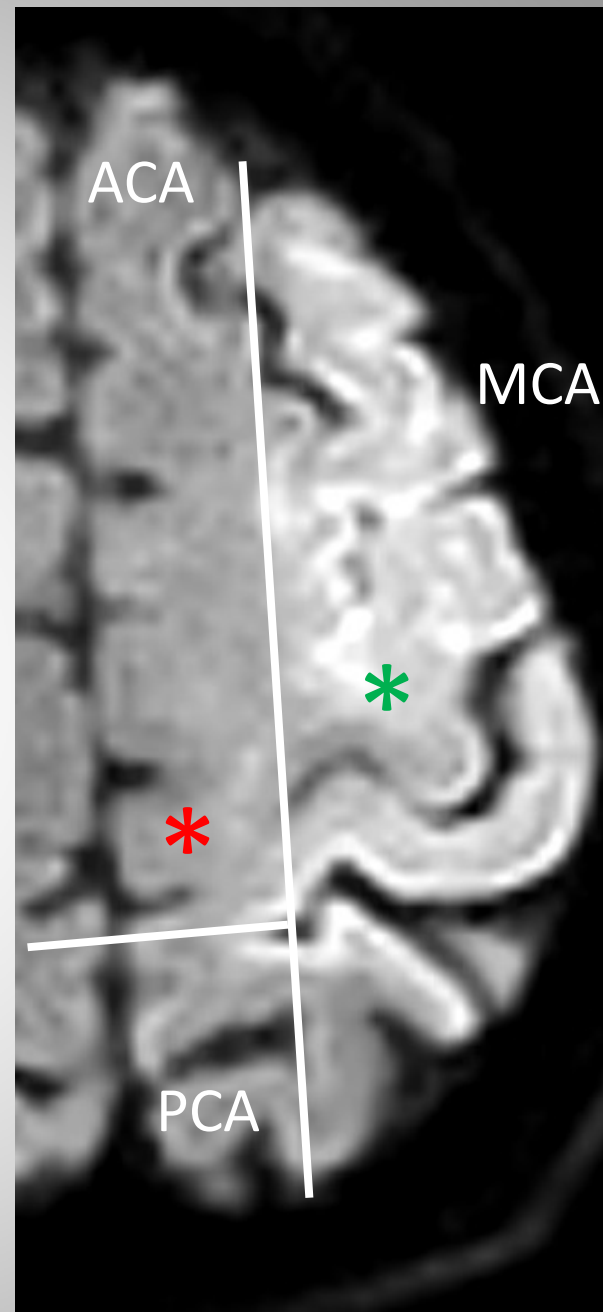
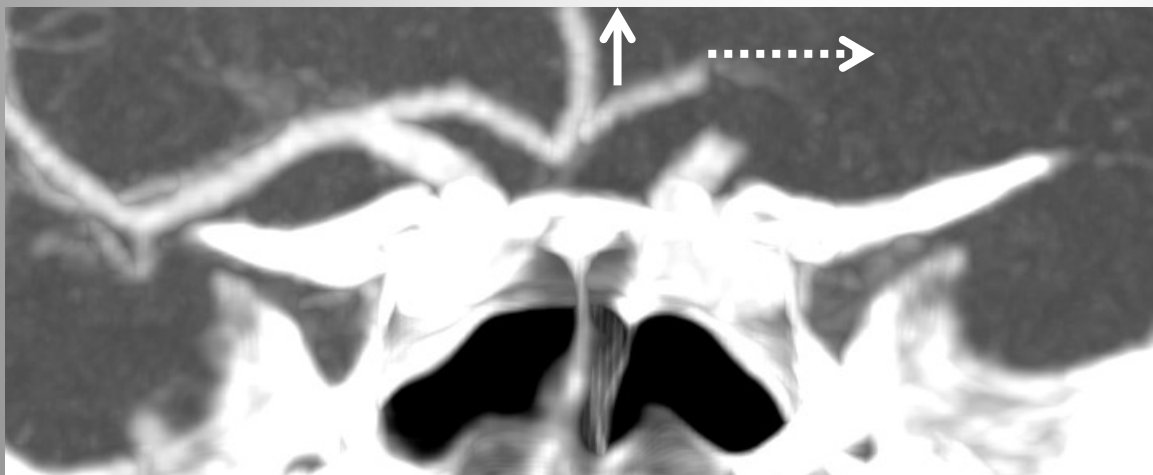
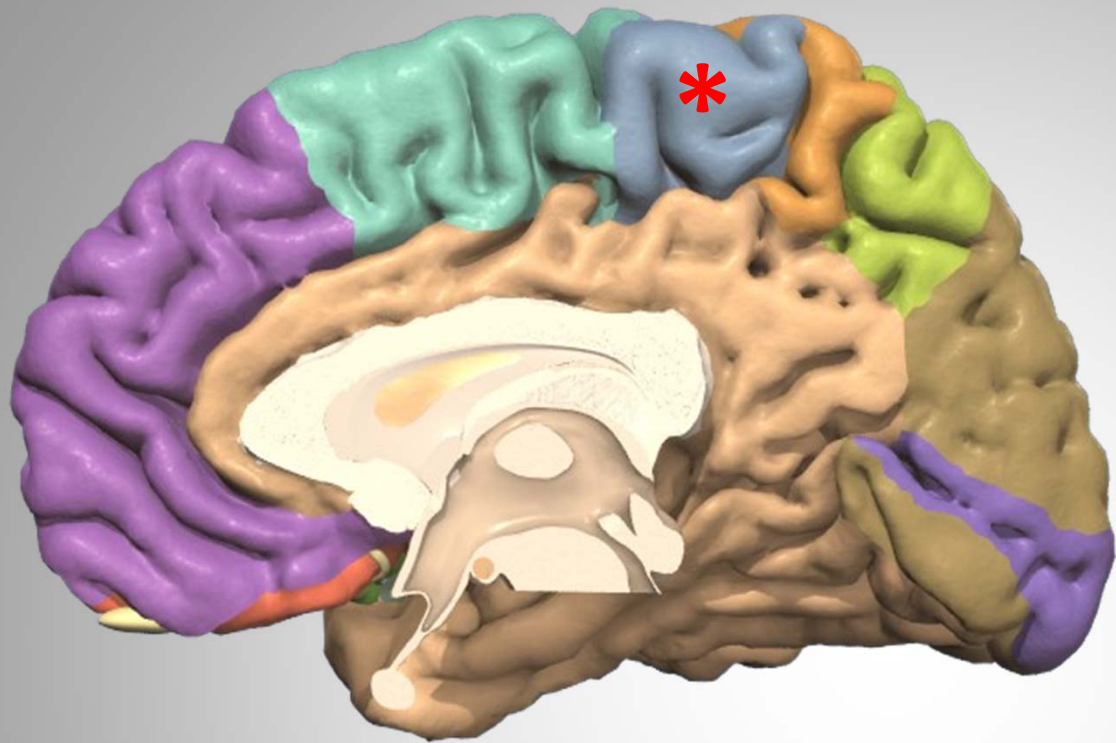


Semiologic tip 5

CT angiogram shows the **arterial STOP**



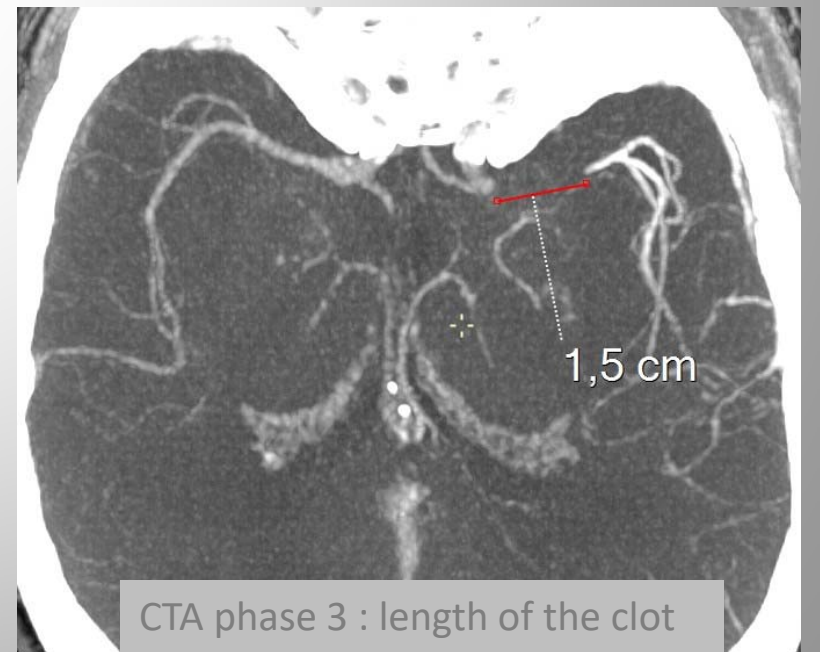
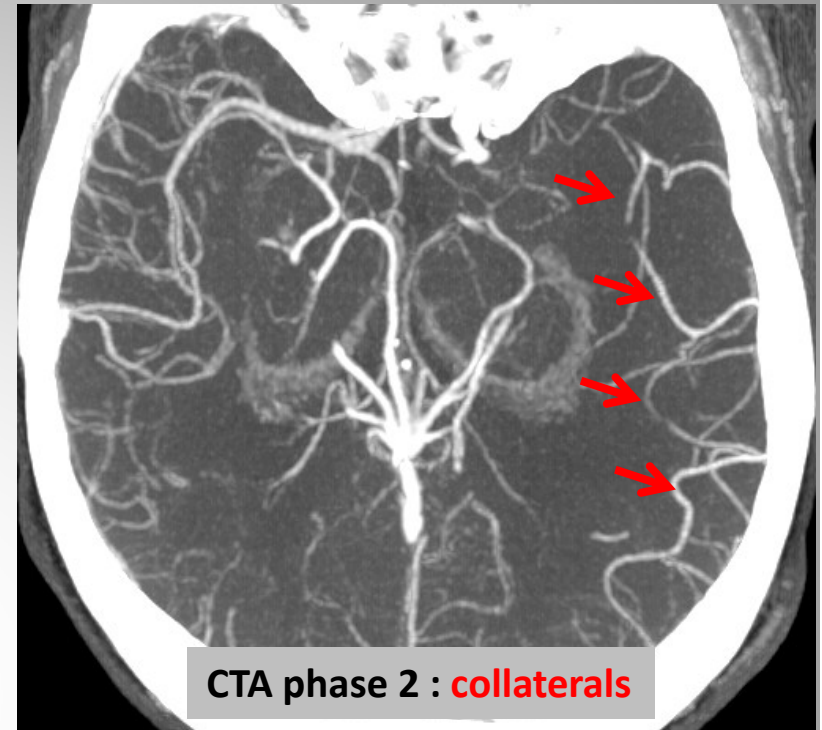
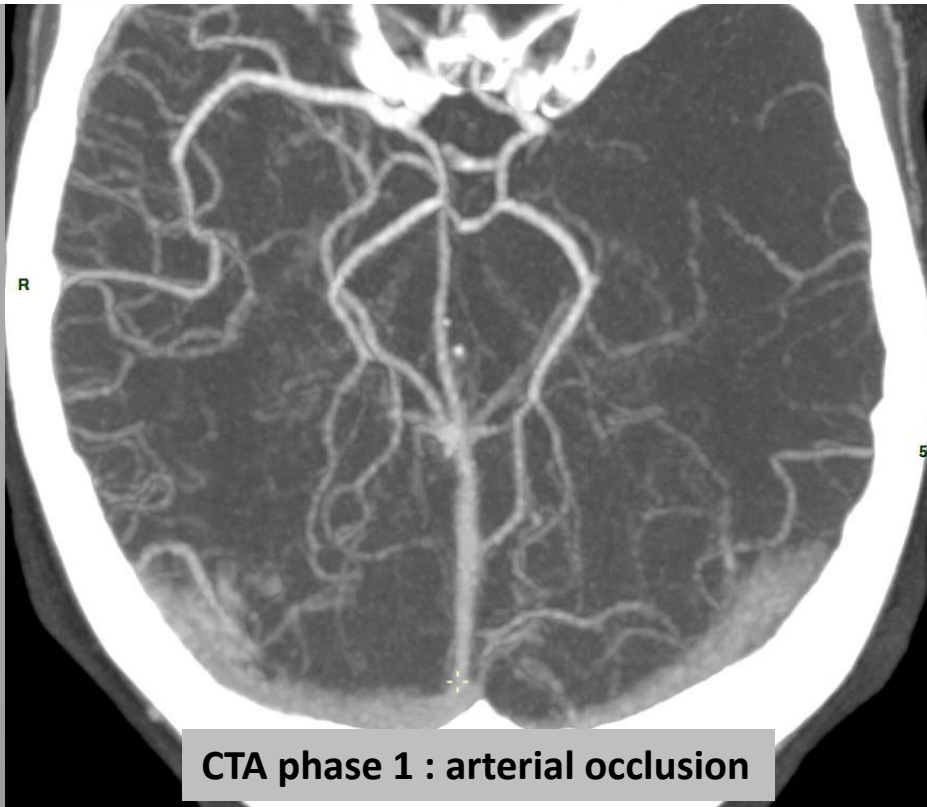
CTA phase 1



Multiphase CT Angiography: A New Tool for the Imaging Triage of Patients with Acute Ischemic Stroke¹

Menon *et al.* *Radiology* 2015; 275:510-517

Radiology



Semiologic tip 6

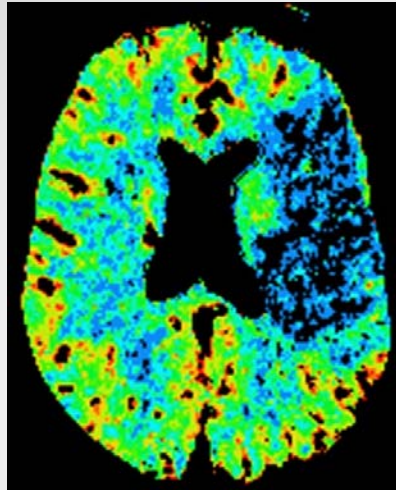
Perform **TRI**-phasic CTA for collaterality evaluation

Type III mismatch

Perfusion imaging = imaging of the 'penumbra'

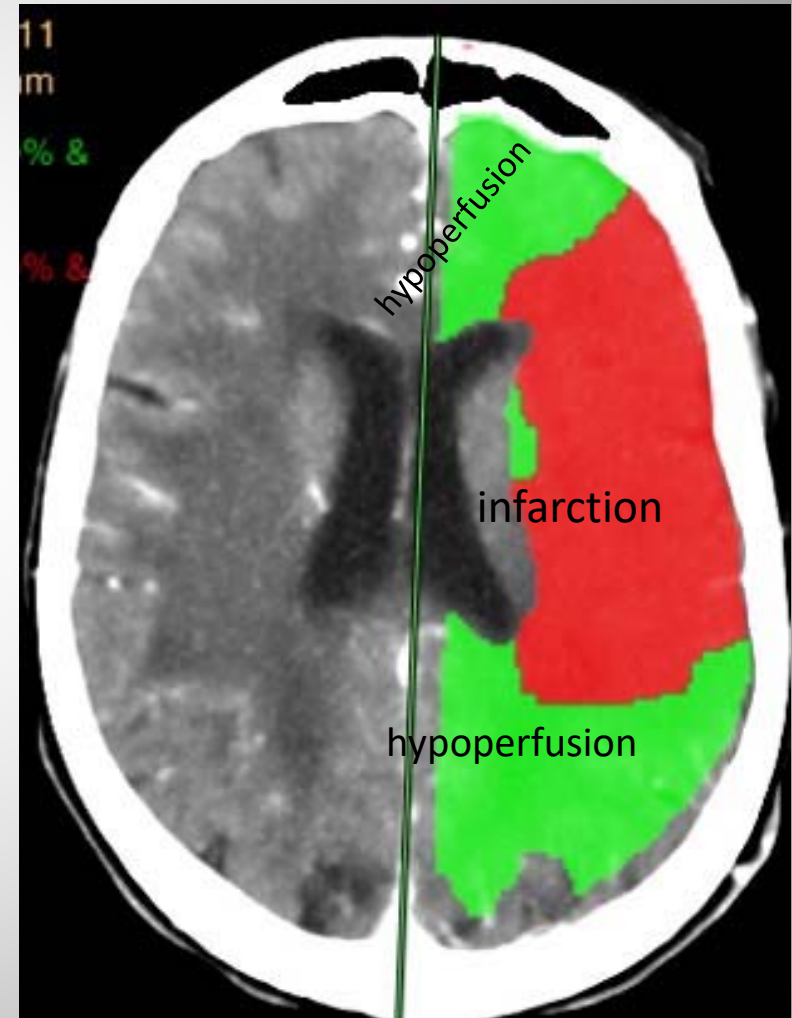
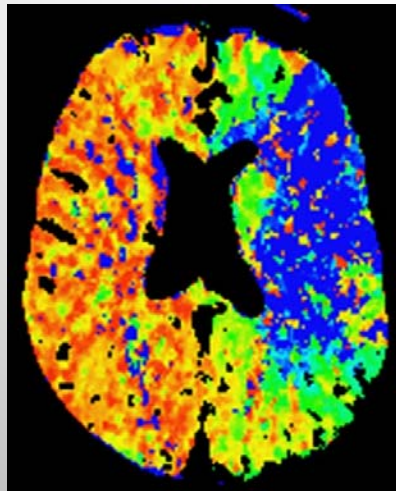
rCBV

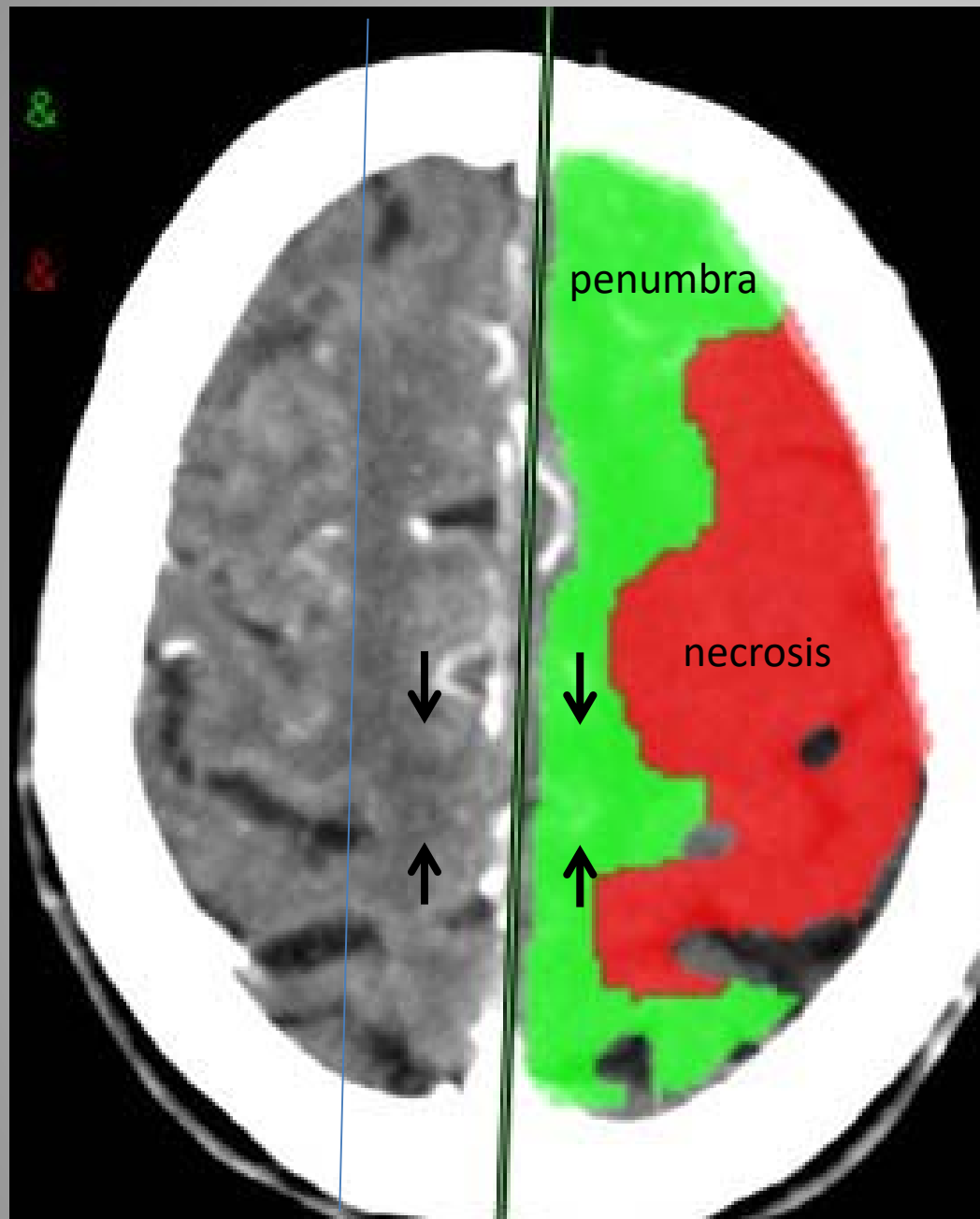
Infarcted <2%



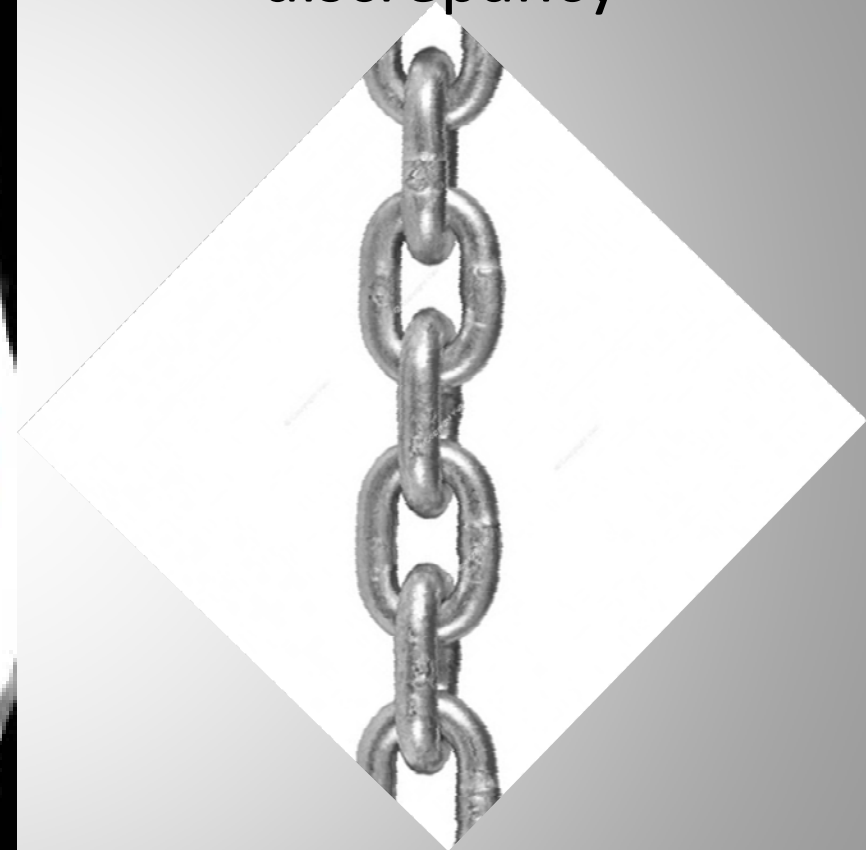
MTT

Hypoperfused > 150%

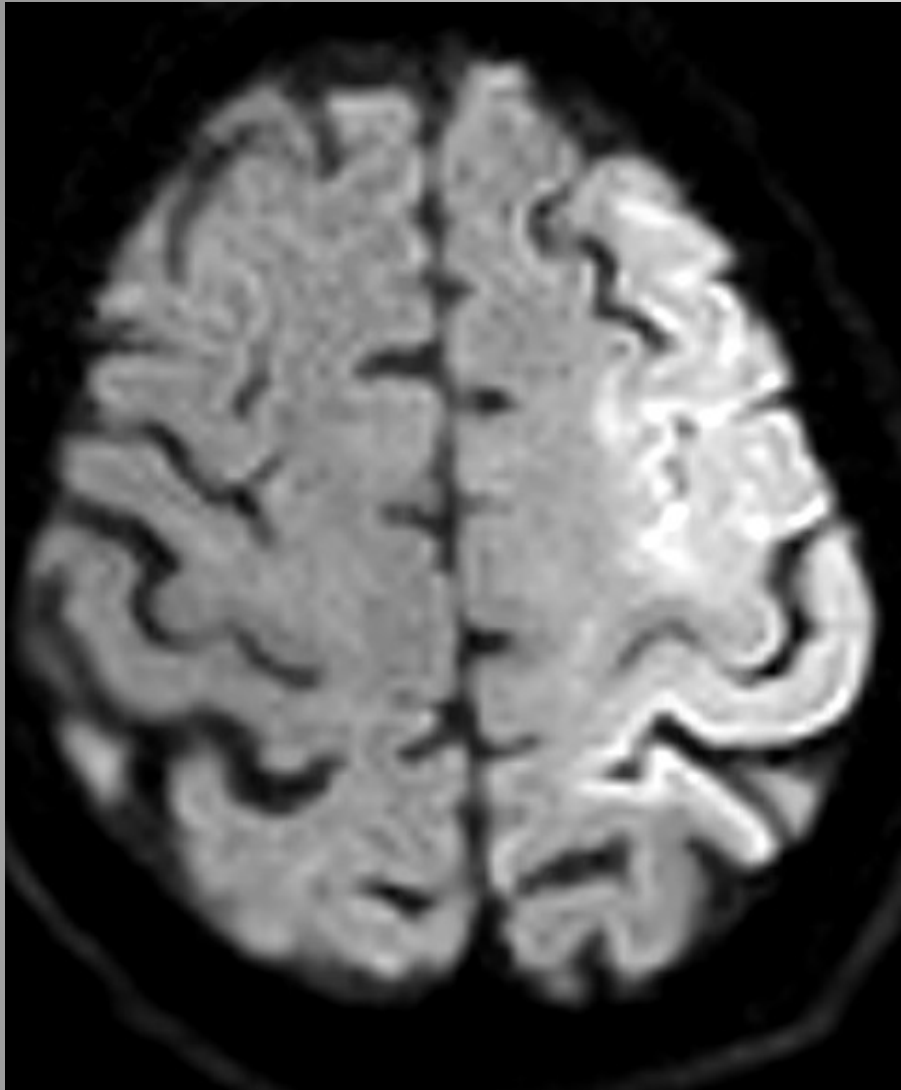




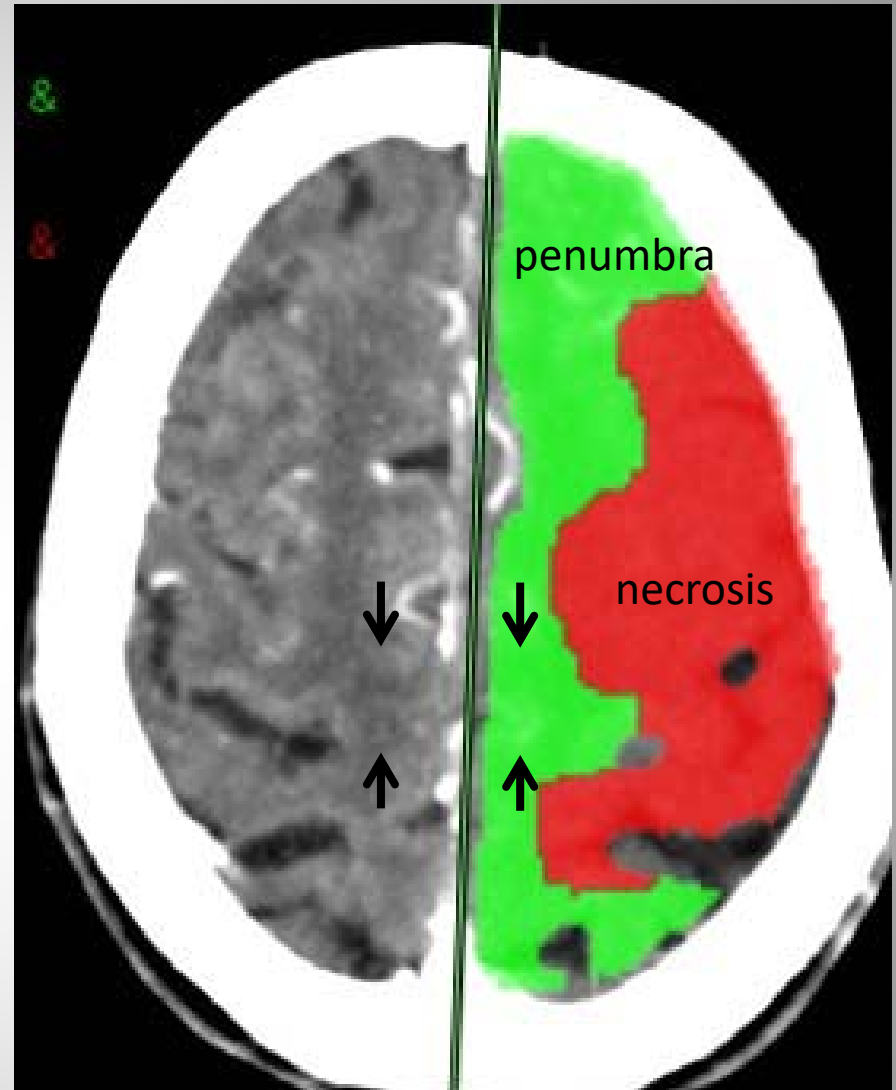
Mismatch type 2
Clinical/radiological
discrepancy



Mismatch type 3
Imaging the penumbra



Diffusion-weighted imaging



Perfusion-weighted imaging

**I see a brain infarcted area
on DW images...
...but...
... it does NOT match the clinical deficit**



Where/which is the missing link ?

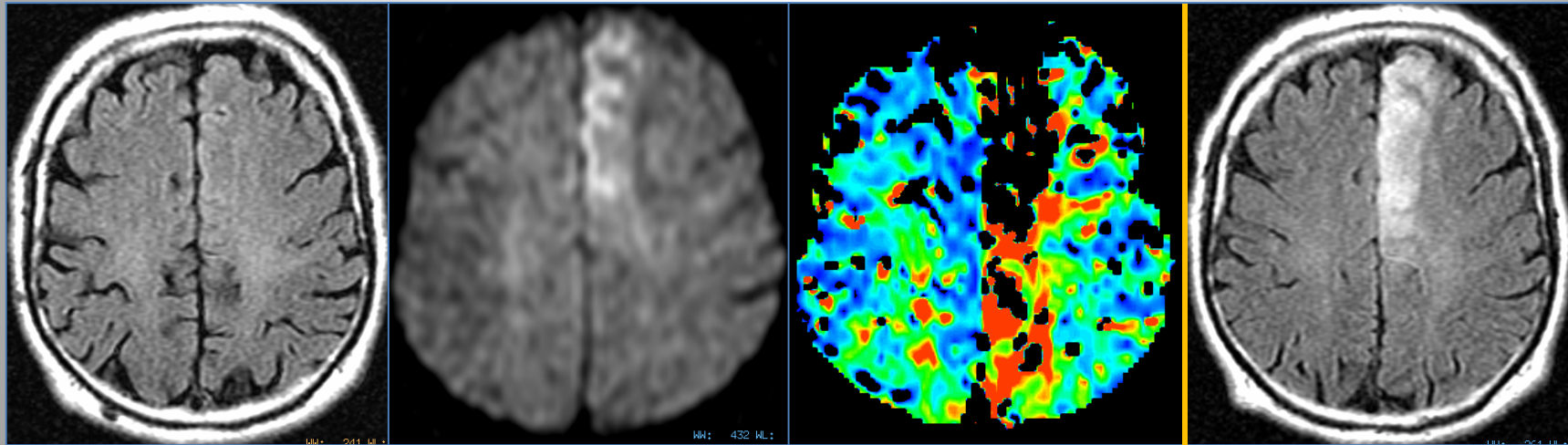


PENUMBRA



Concept tip 3

The so-called '**penumbra**' is the hypoperfused brain tissue at risk of infarction if the O₂ deprivation persists



FLAIR 4 hours

DWI 4 hours

PWI 4 hours

FLAIR 24 hours

Presence of penumbra...
... within eloquent areas



**recanalization
therapy**