Guidelines et perspectives évolutives

Démence

Tumeurs cérébrales

Imagerie et management du stroke aigu

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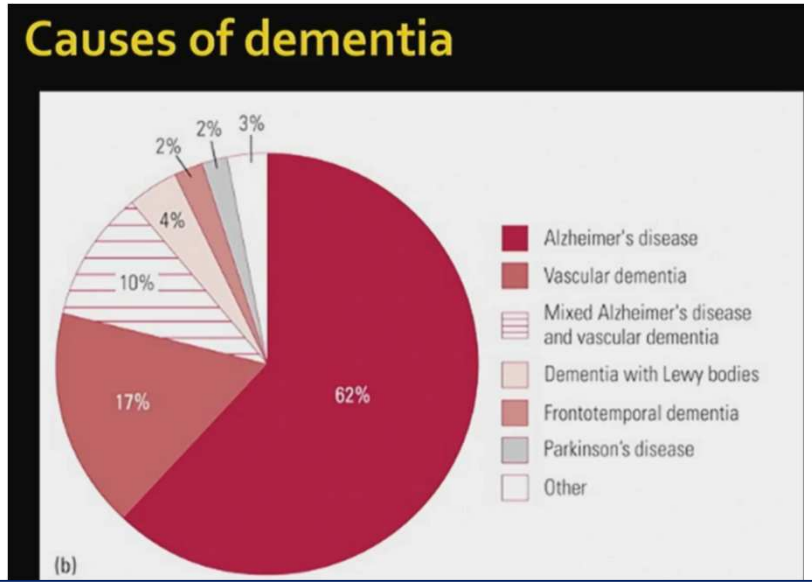
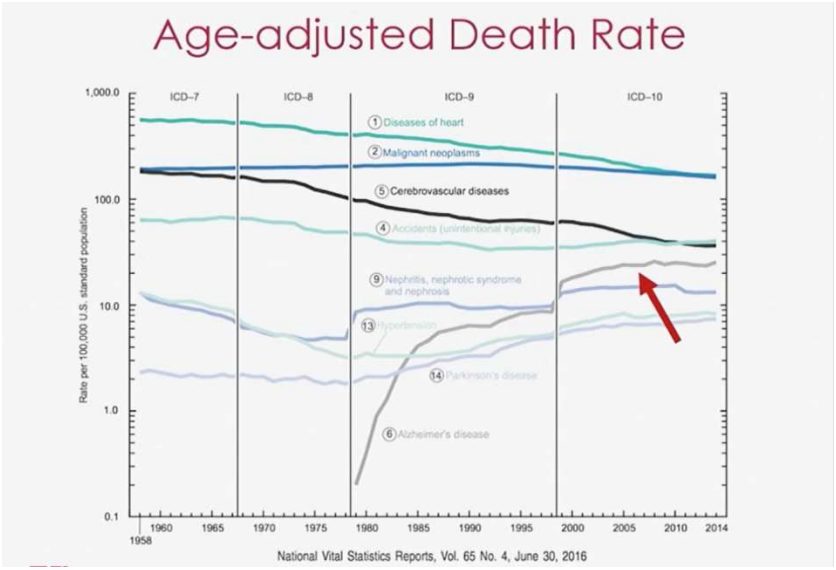
DES Radiodiagnostic 15 décembre 2017

ULB - Erasme

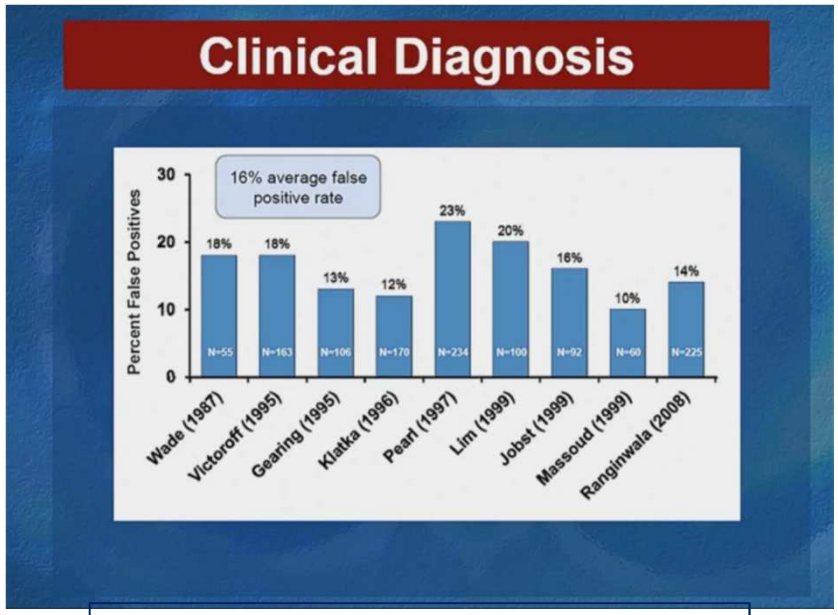
Imagerie de la DEMENCE



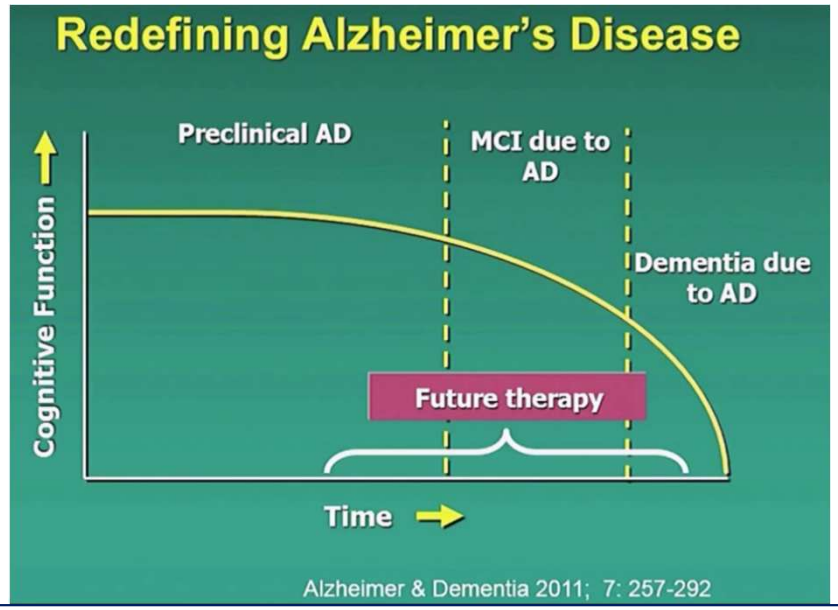
Place de l'AD dans les démences 'dégénératives'



5.5 millions d'AD aux USA



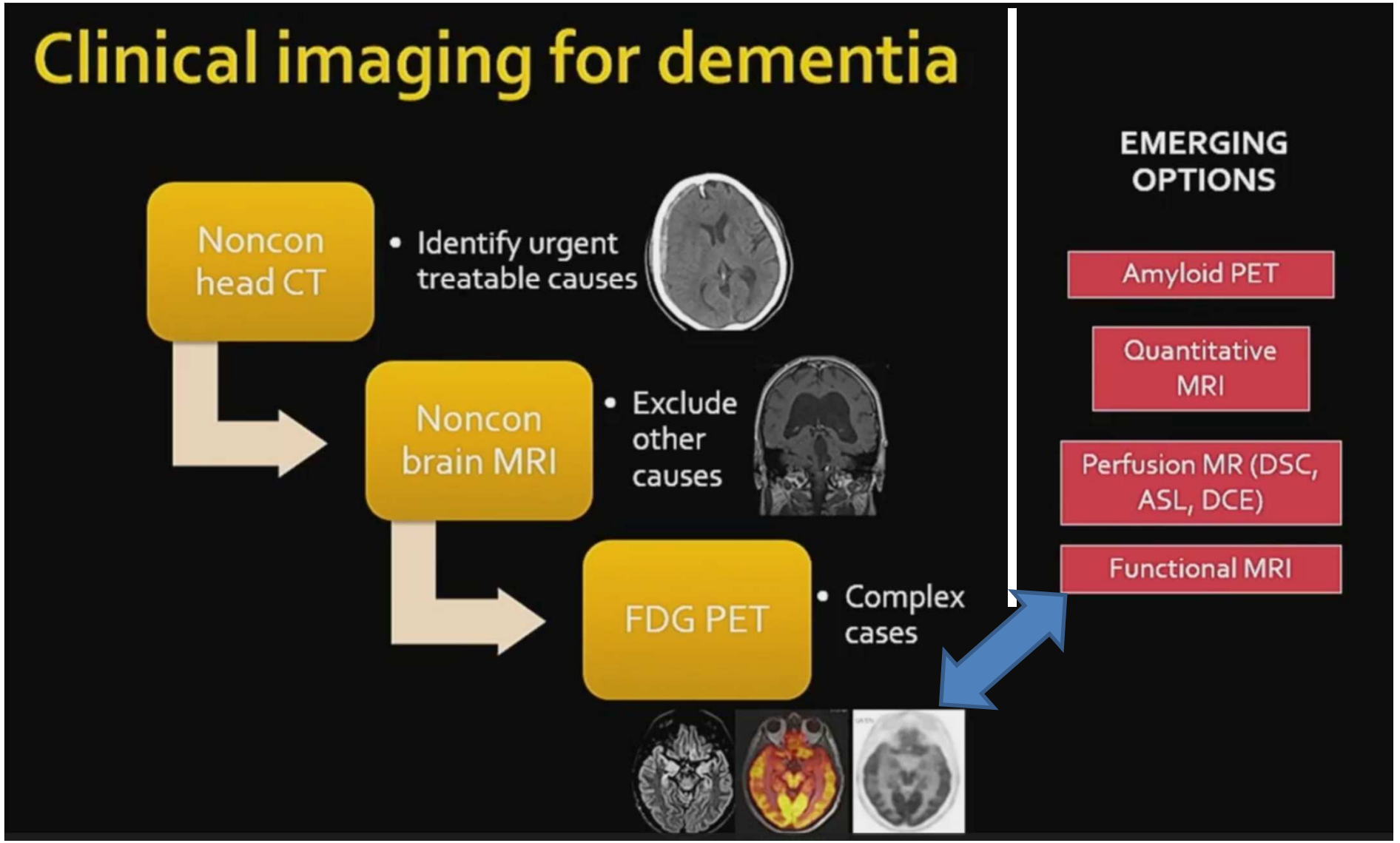
Précision diagnostique clinique



Thérapies ciblées (anti-amyloïdes et anti-tau)

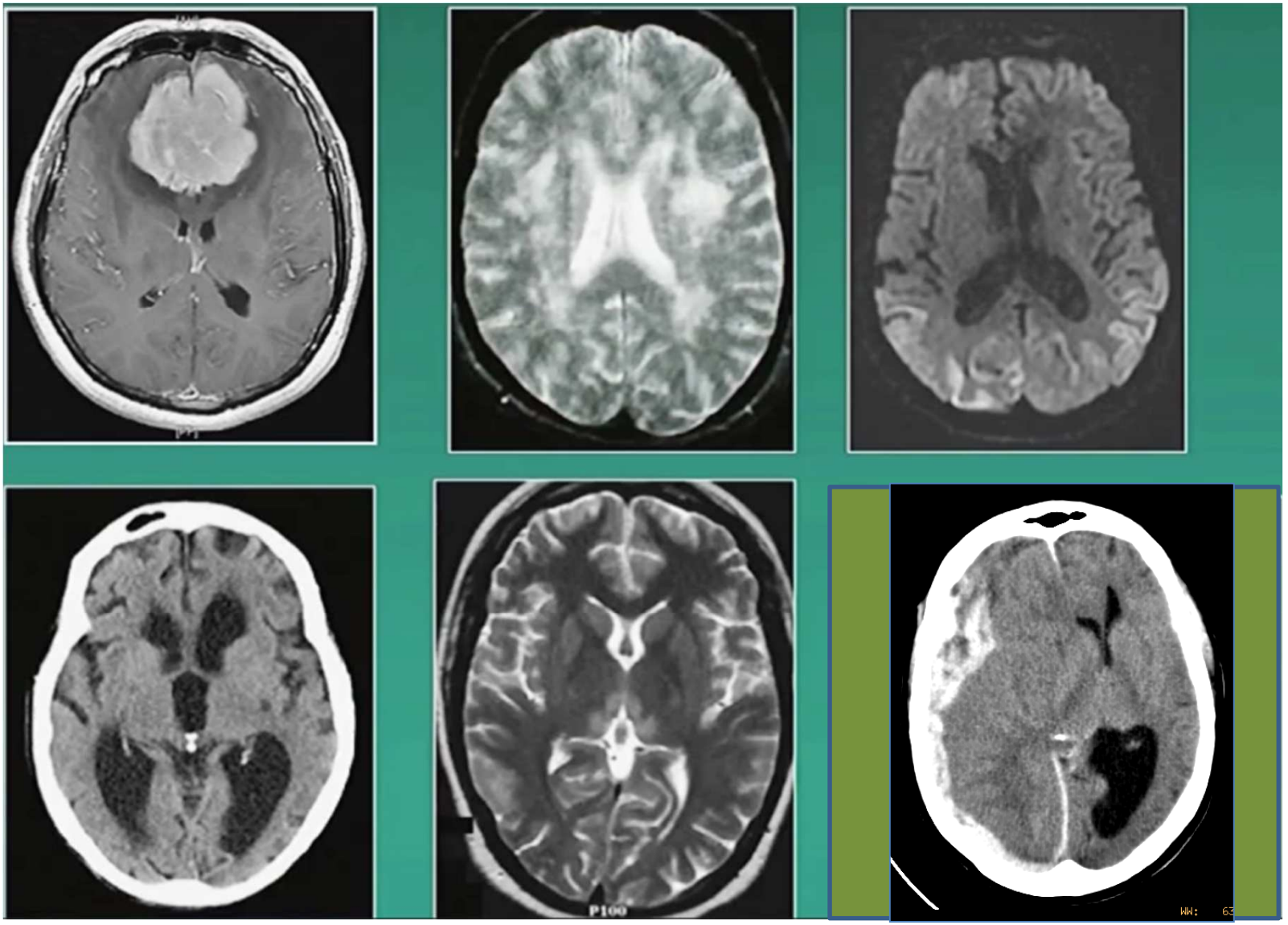
FDA-approved techniques for imaging dementia

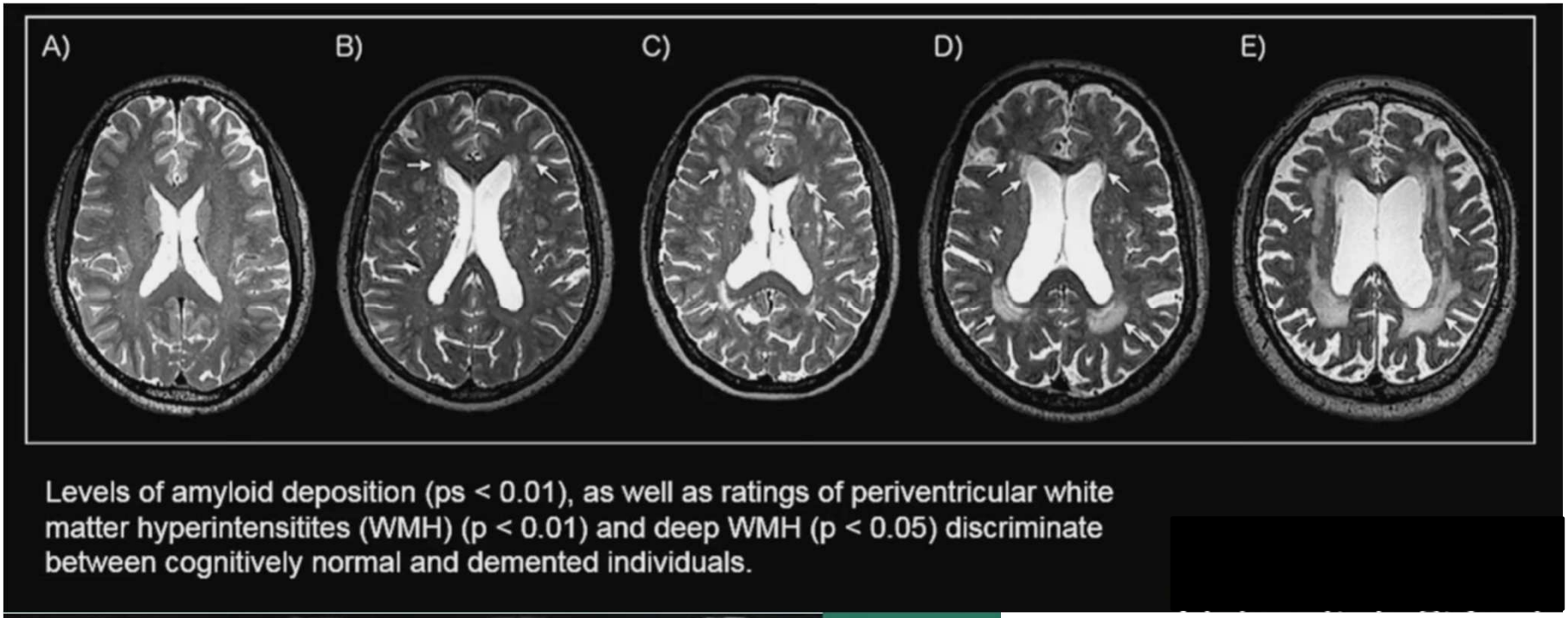
Reimbursement by Health Care System

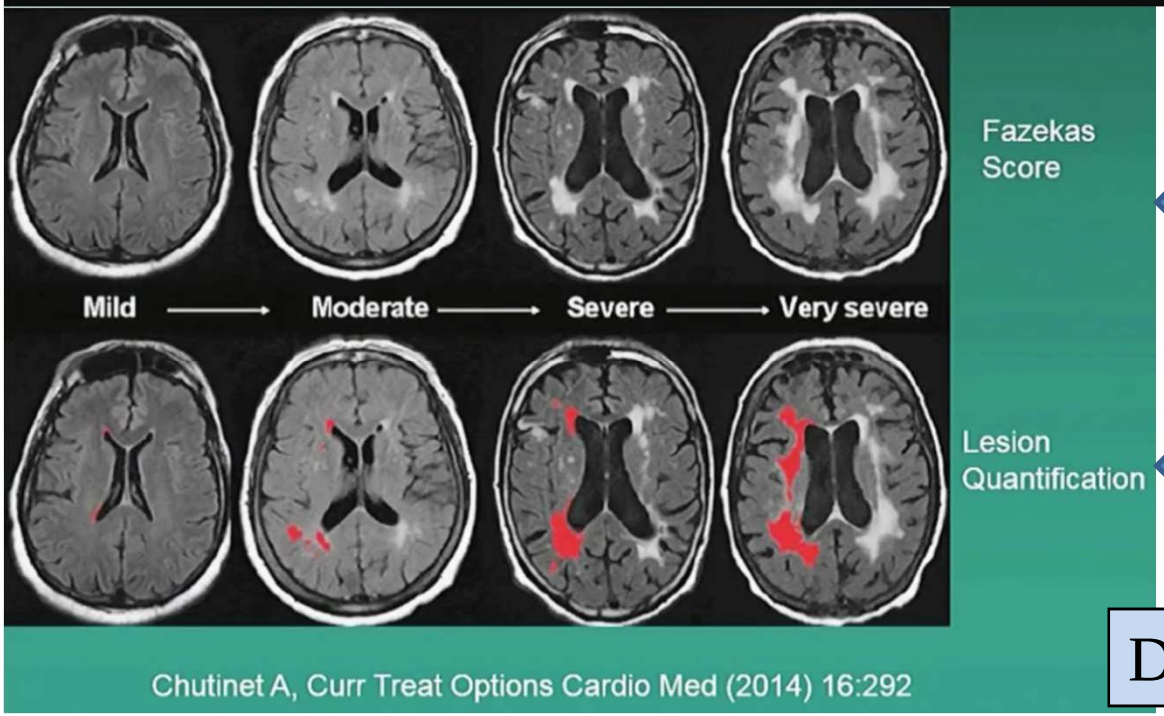


Imagerie morphologique CT/IRM

→ démences ‘secondaires’ (non ‘moléculaires’)



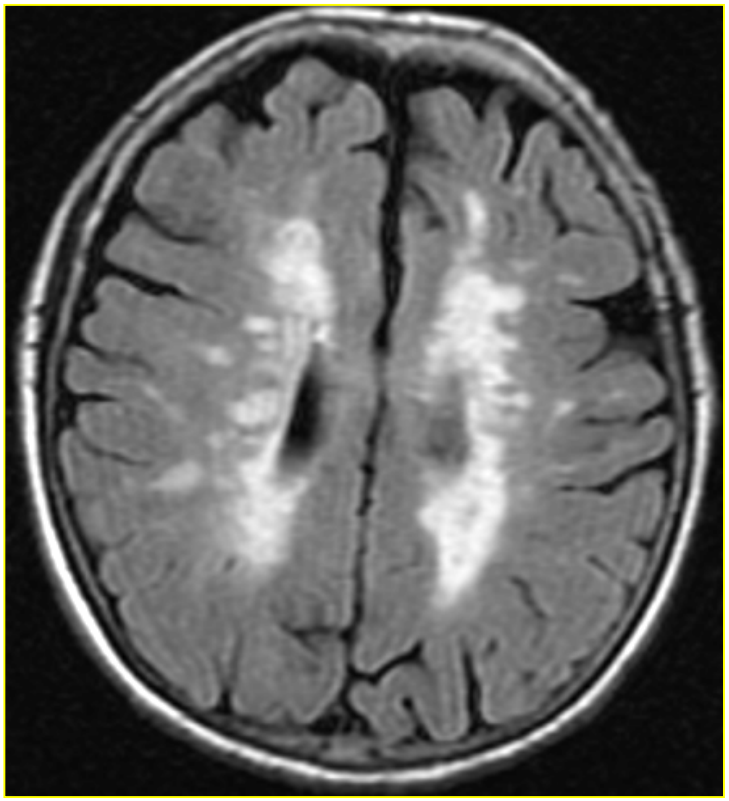


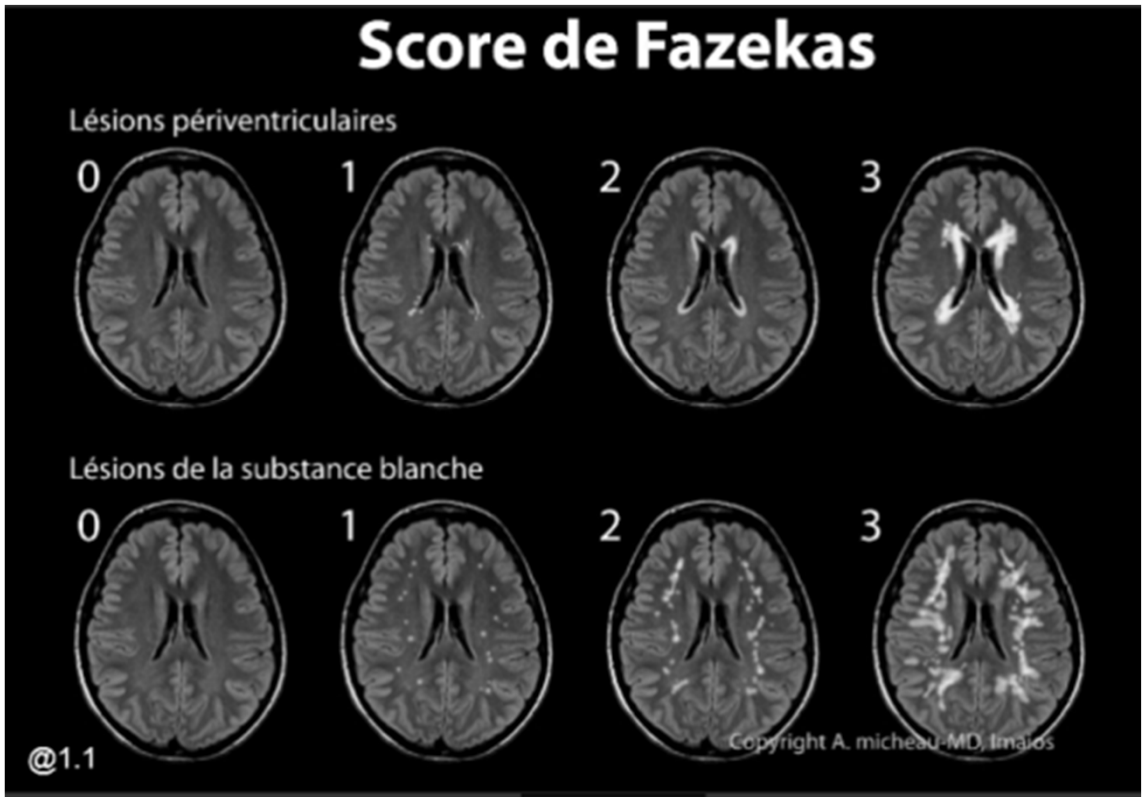


Semi-quantitatif
'visuel'

Quantitatif
morphométrique

Démence micro-vasculaire



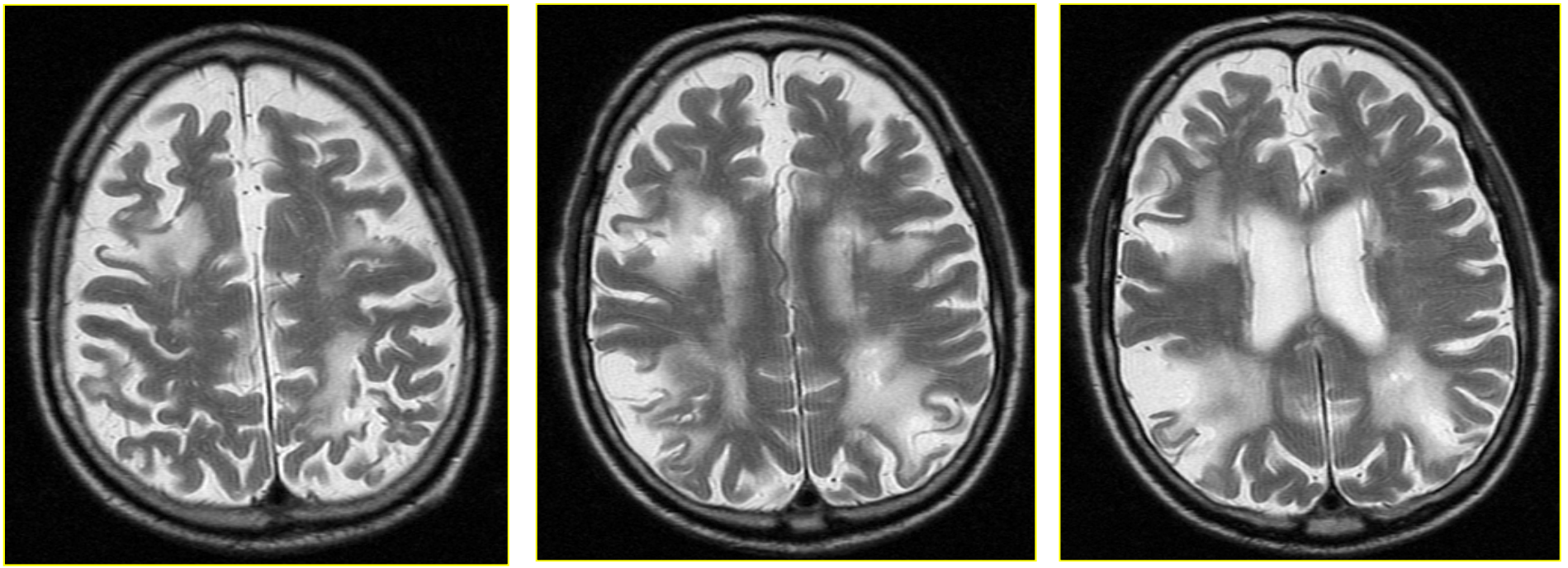


'Leucoaraiose sévère'

'Fazekas grade 3'

Démence micro-vasculaire sous-corticale
'Leucoariose pathologique'
« Subcortical Arteriosclerotic Encephalopathy » **SAE**
Binswanger's Disease

Démence macro-vasculaire

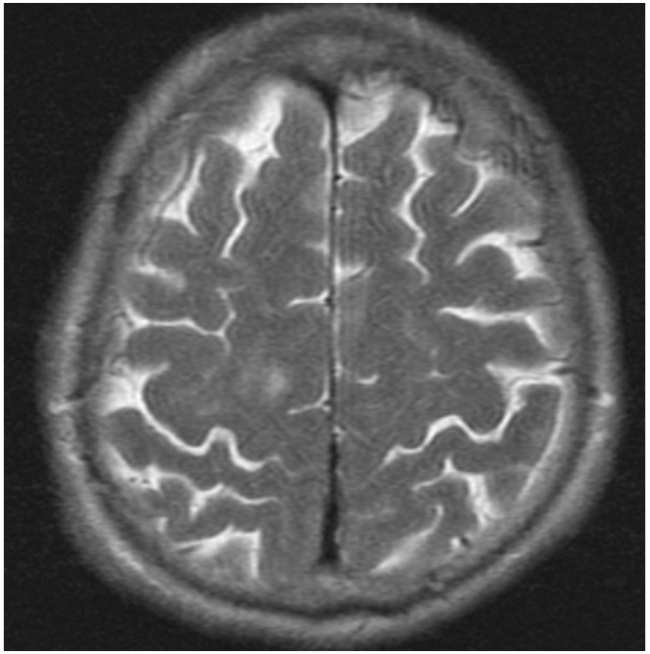


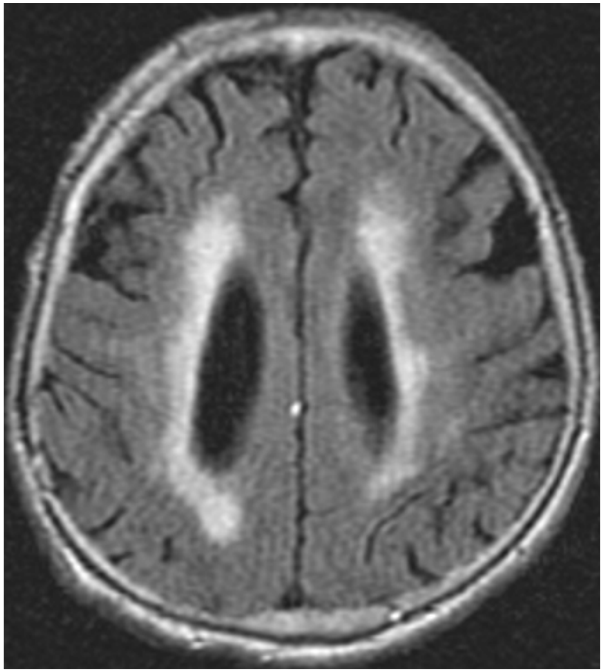
***MID*: Multi Infarct Dementia**

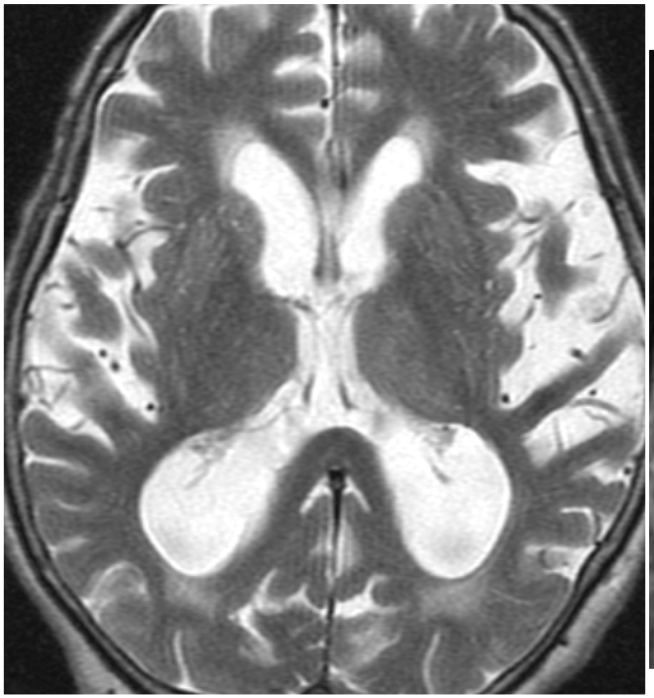
Démence micro-vasculaire

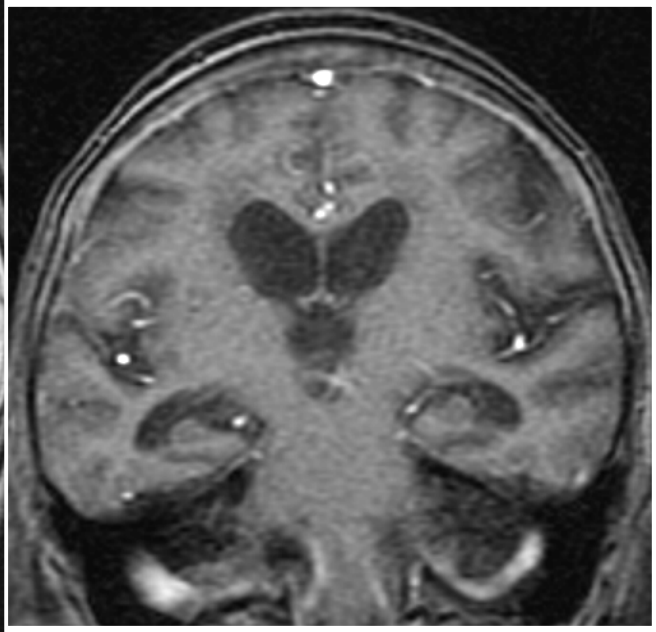
Démence macro-vasculaire

→ Imagerie morphologique







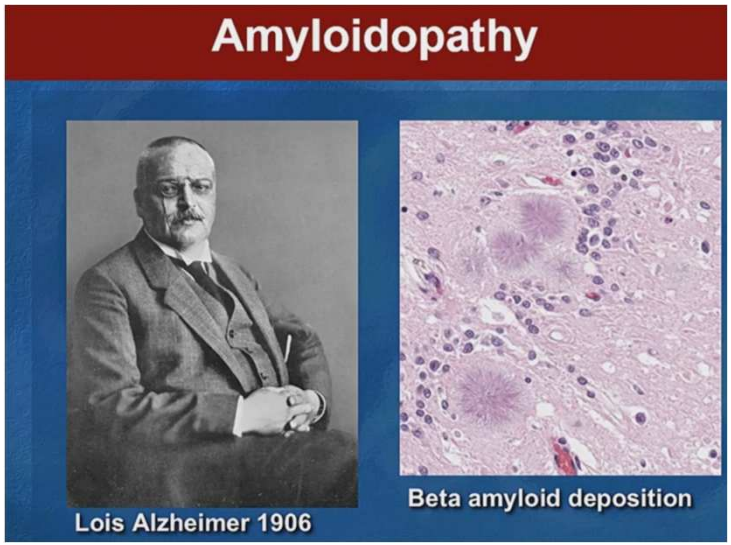


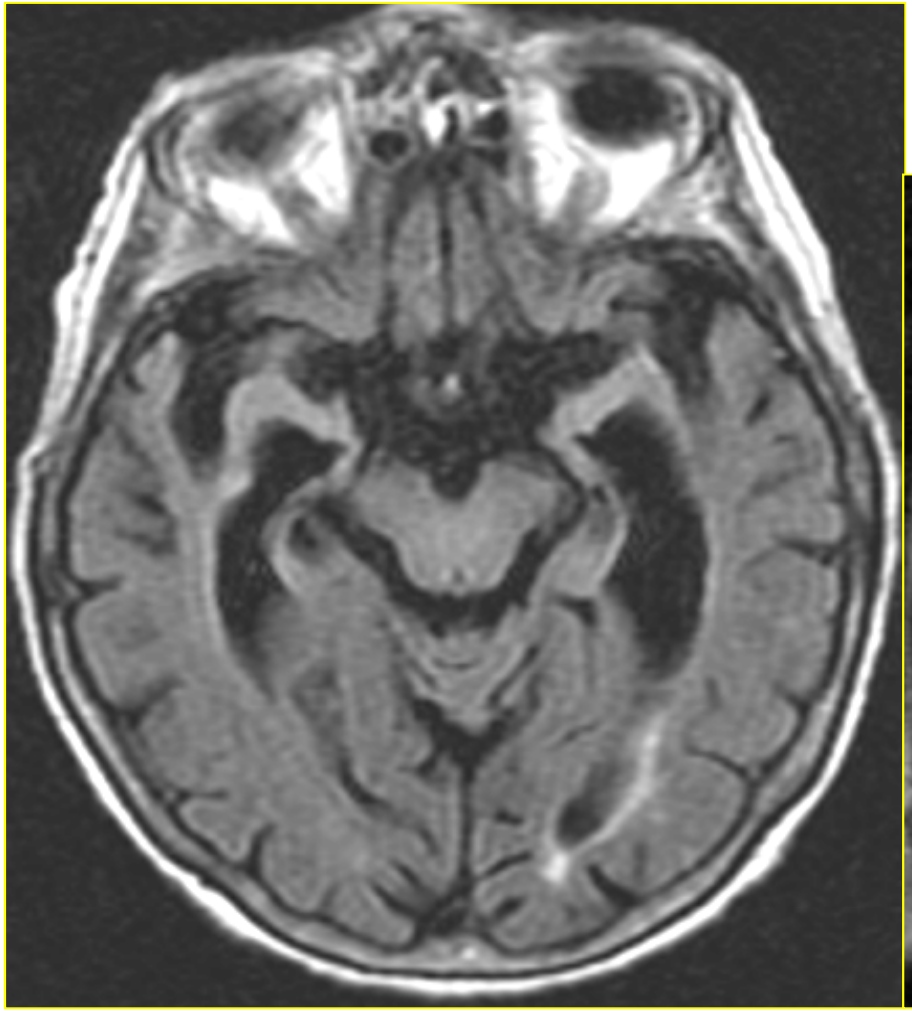
Hydrocéphalie normo-tensive NPH

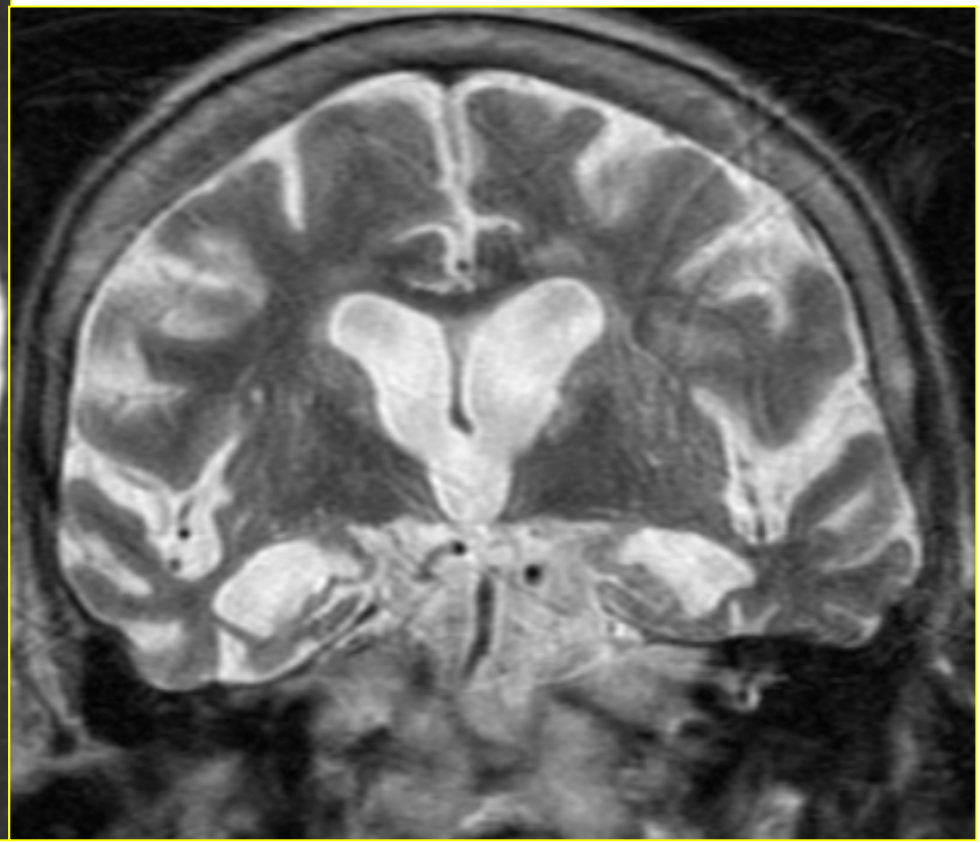
Diagnostic de certitude pour décision chirurgicale:

- PIC de 48 heures
- Tap test (30-50 ml de LCR)
- Vélocimétrie PC du LCR

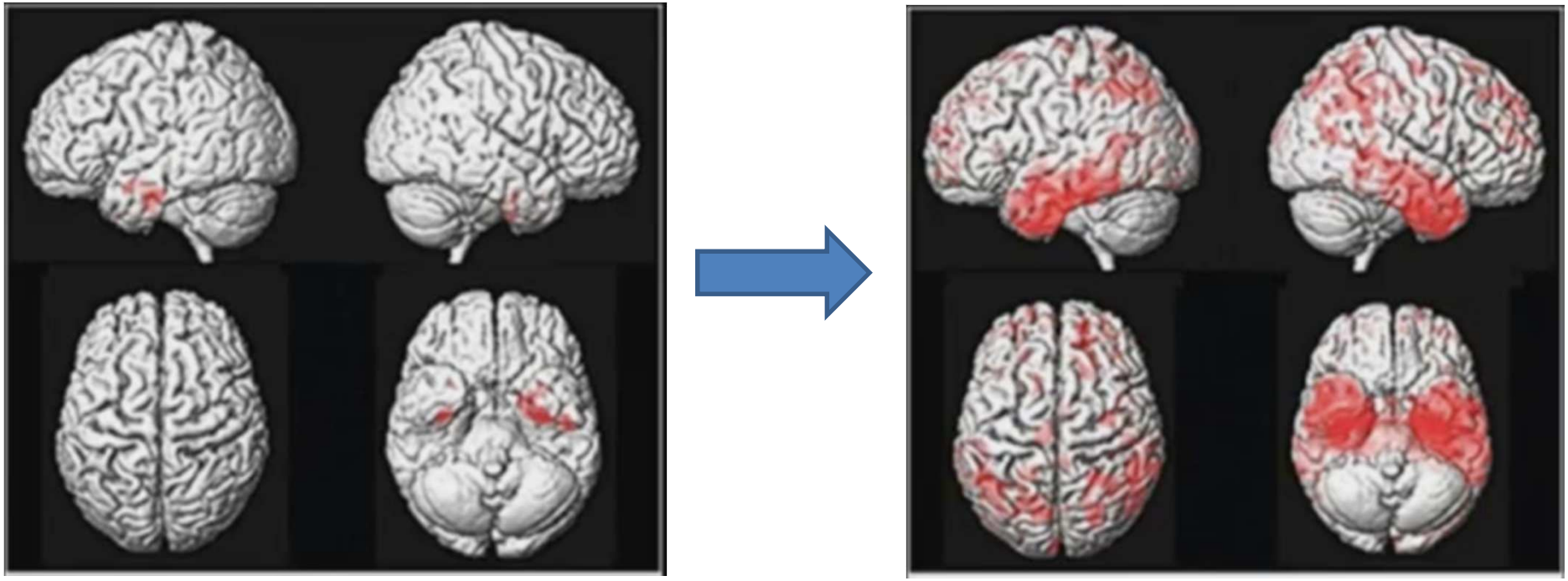
Démence ‘moléculaire’ 1





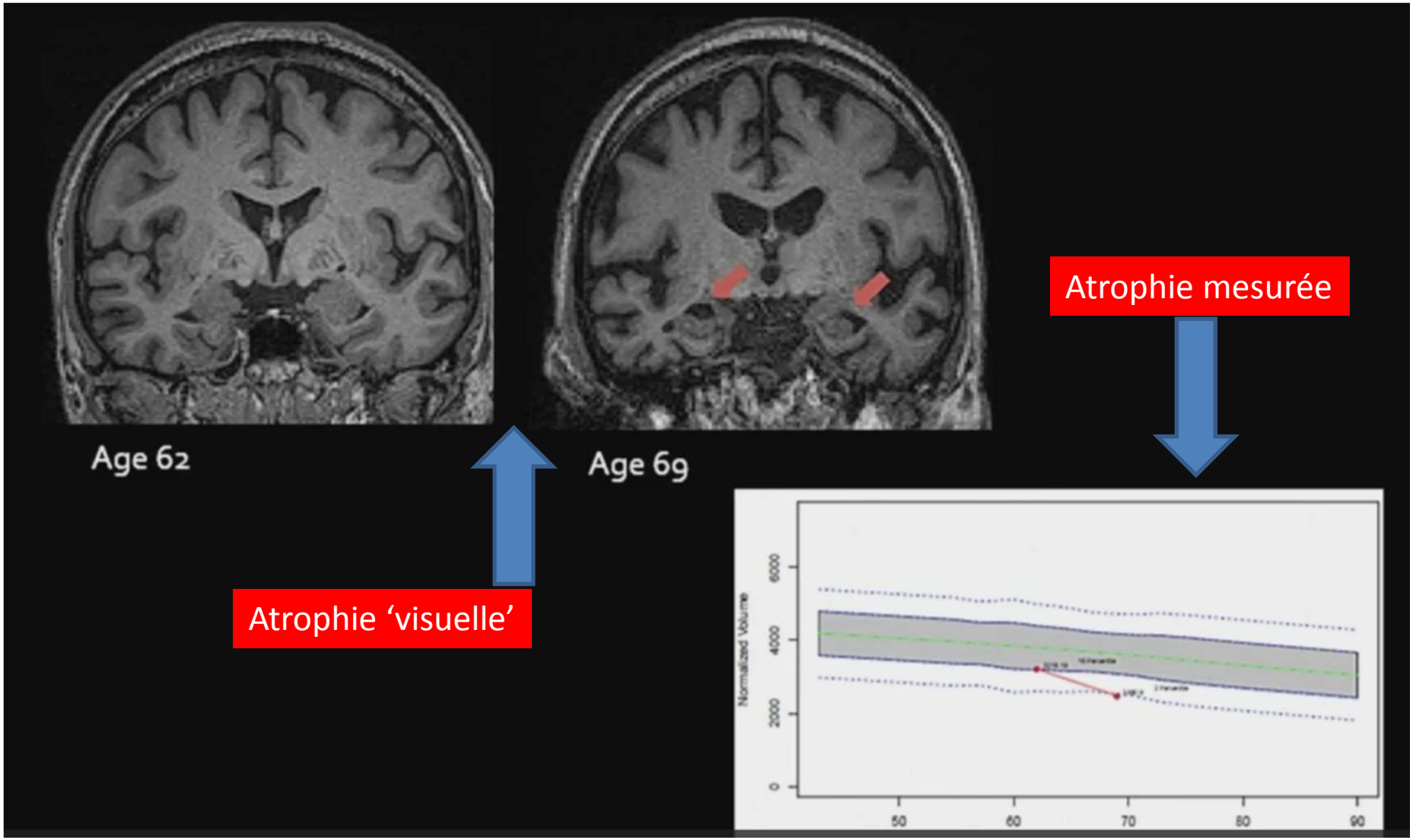


L'atrophie mésio-temporale précède l'expression symptomatique démentielle catégorisée

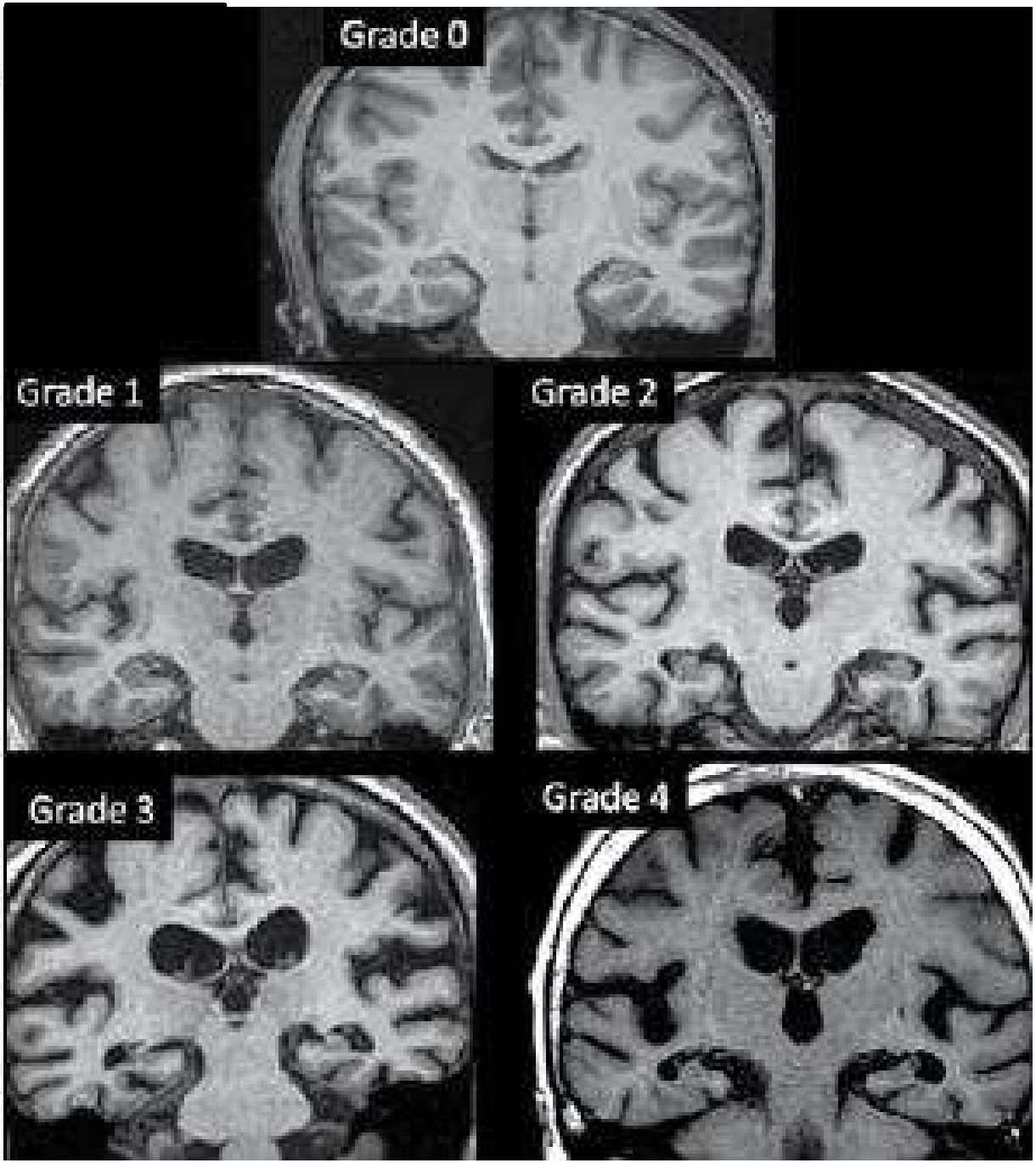


MCI mnésique 3 ans
avant le diagnostic d'AD

MCI mnésique progressif
au moment du diagnostic d'AD

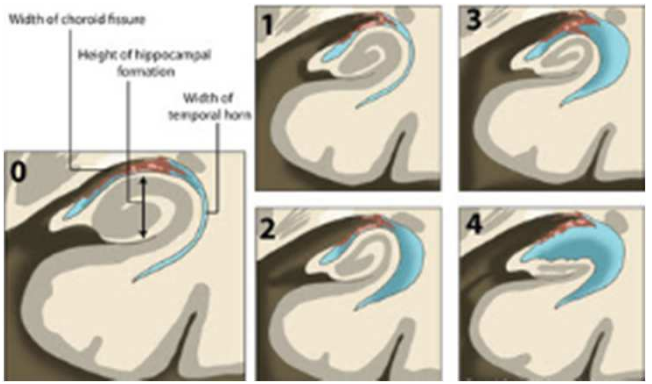


Pattern typique d’AD: atrophie hippocampique élective



Echelle de Scheltens

Volumétrie
semi-quantitative
visuelle



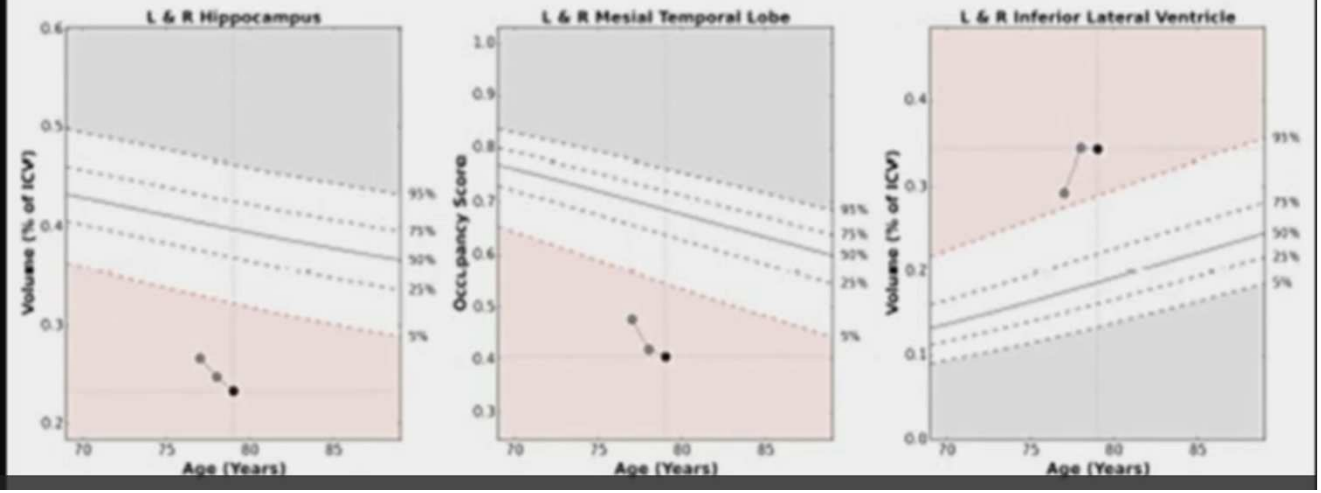
Clinical volumetric MRI

Case 1

Classic AD pattern

Hippocampal Occupancy Score (HOC)		0.41	
Brain Structure	Volume (cm³)	% of ICV (5%-95% Normative Percentile*)	Normative Percentile*
Hippocampi	4.46	0.23 (0.32-0.46)	< 1
Lateral Ventricles	125.25	6.55 (1.85-4.98)	> 99
Inferior Lateral Ventricles	6.54	0.34 (0.13-0.29)	99

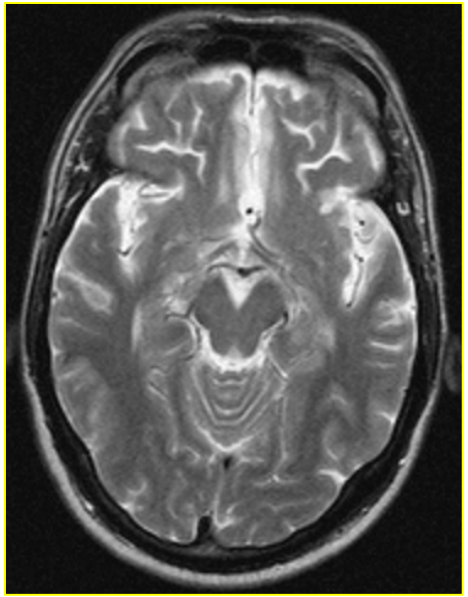
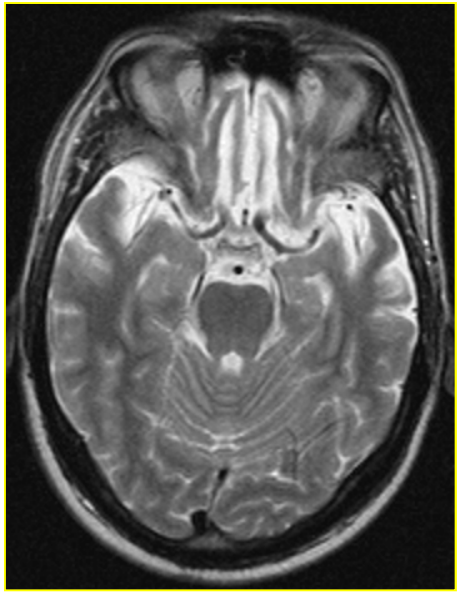
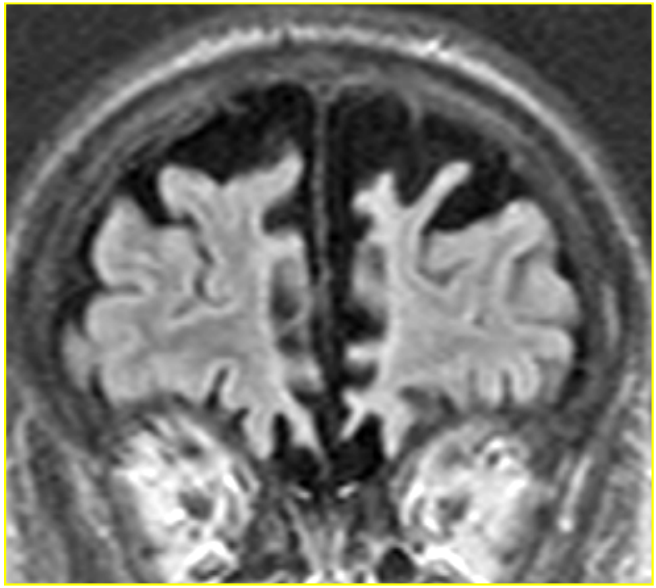
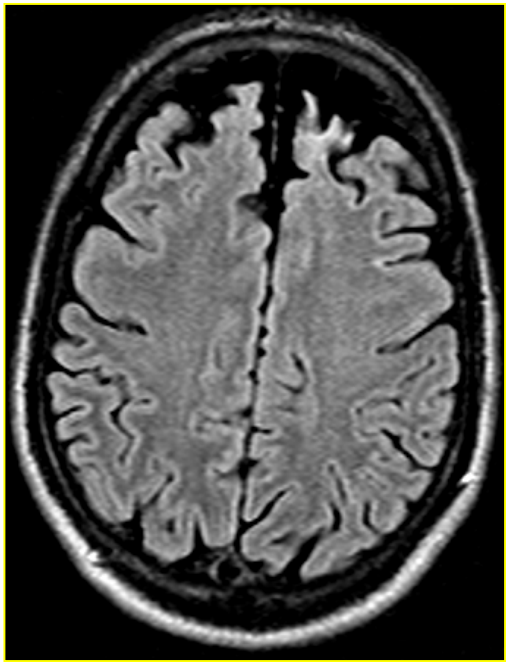
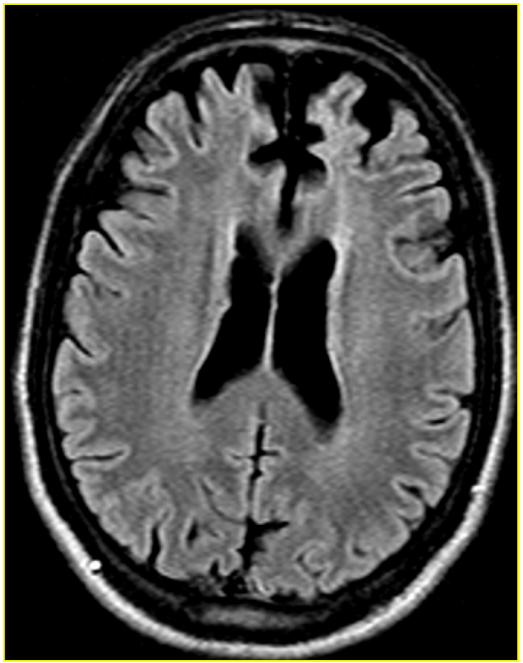
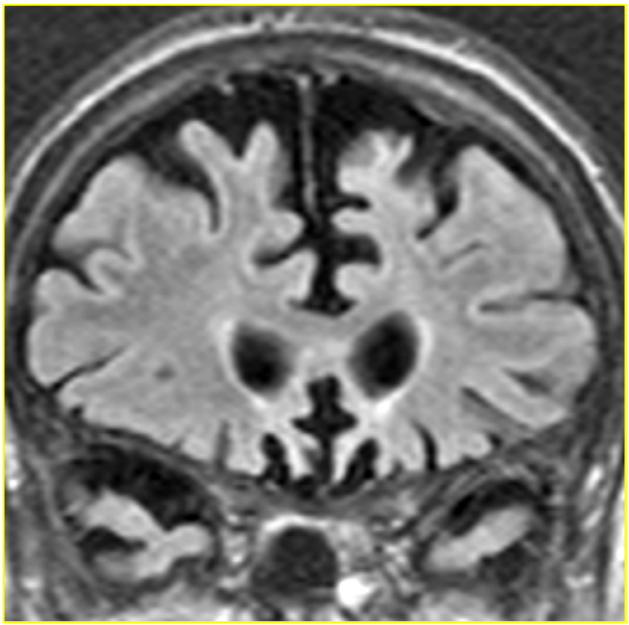
AGE-MATCHED REFERENCE CHARTS



Volumétrie numérisée

Démence ‘moléculaire’ 2

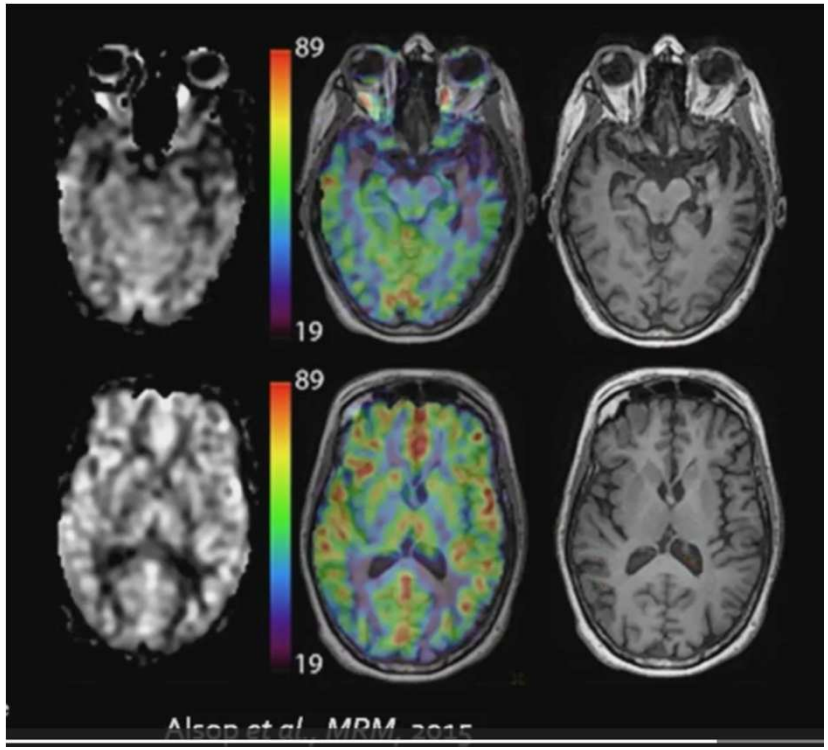
Démence fronto-temporale ou maladie de Pick

Démence ‘moléculaire’ 3

CBD
Cortico-Basal Degeneration

Atrophie cérébrale globale aspécifique



Démence ‘moléculaire’ 4

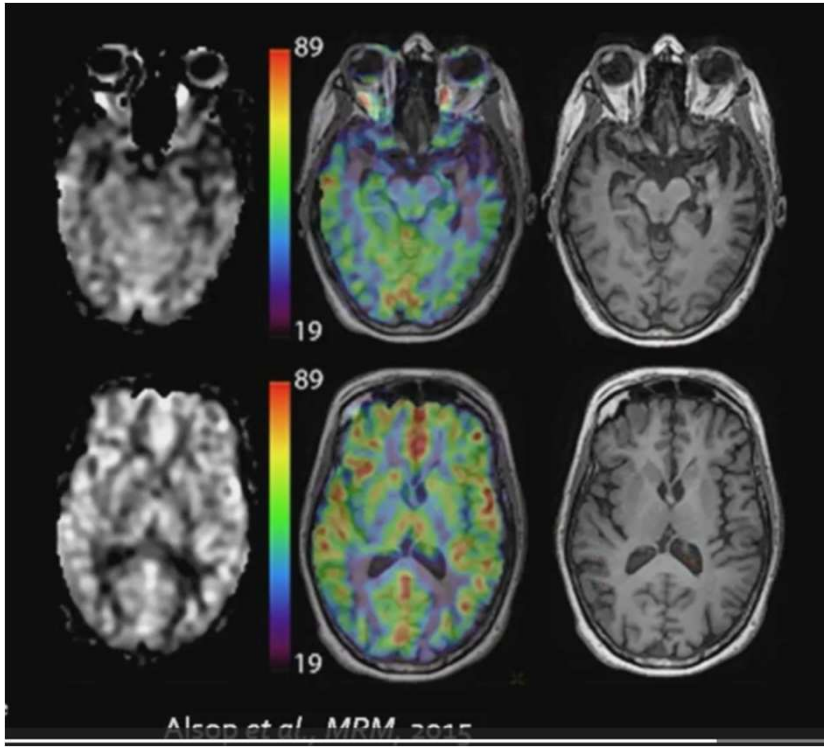
LBD
Lewy Body Degeneration

Atrophie pariétale
avec élargissement des sillons
central, post-central et moins précentral

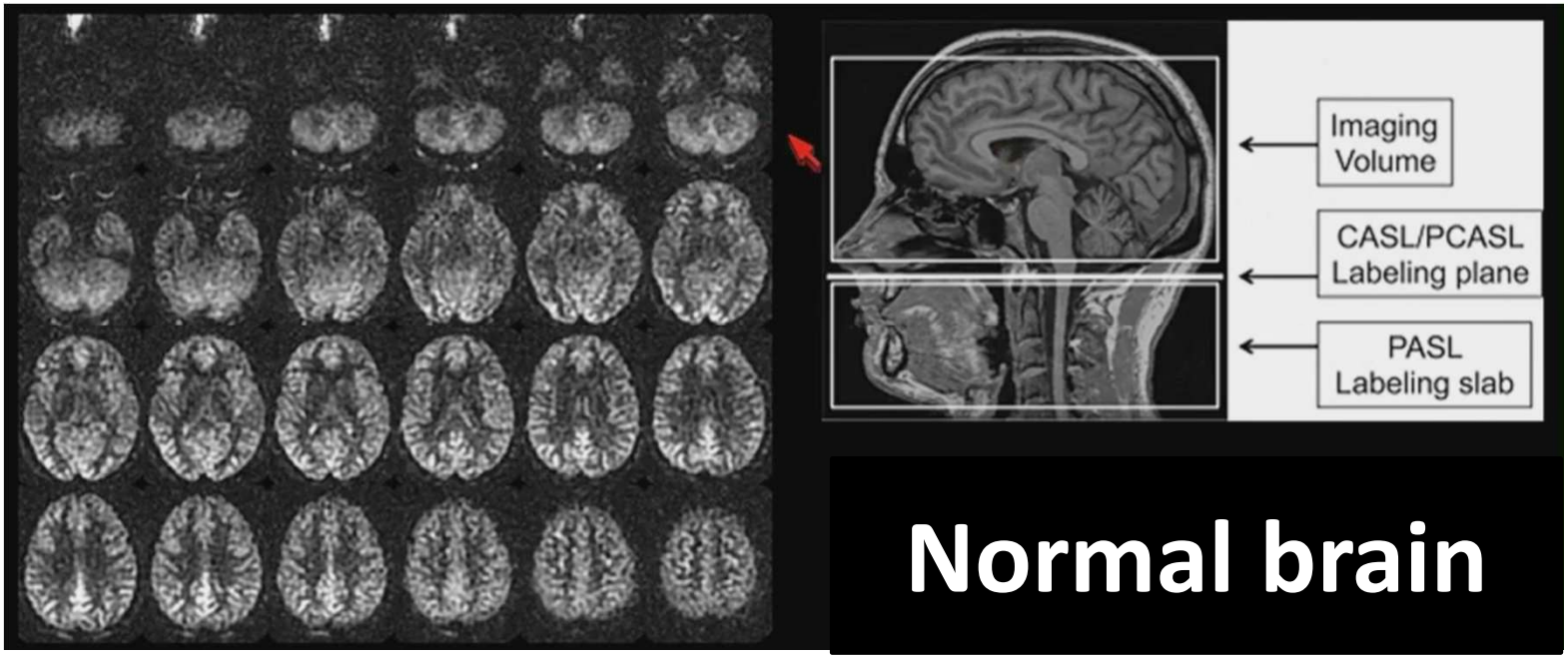
Démence ‘moléculaire’ 5

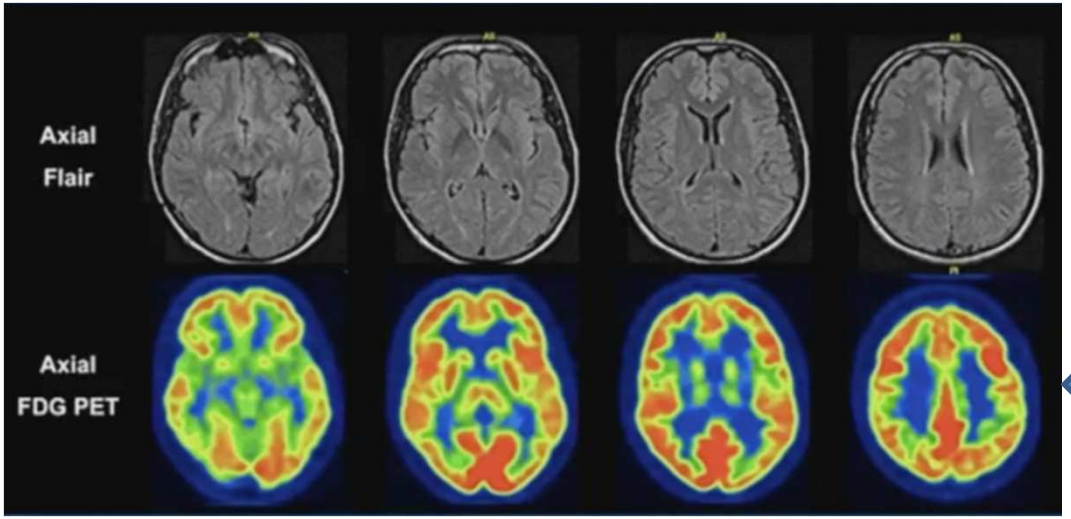
Aphasie dégénérative primaire

Co-registration de la perfusion ASL
avec l’image morphologique T1



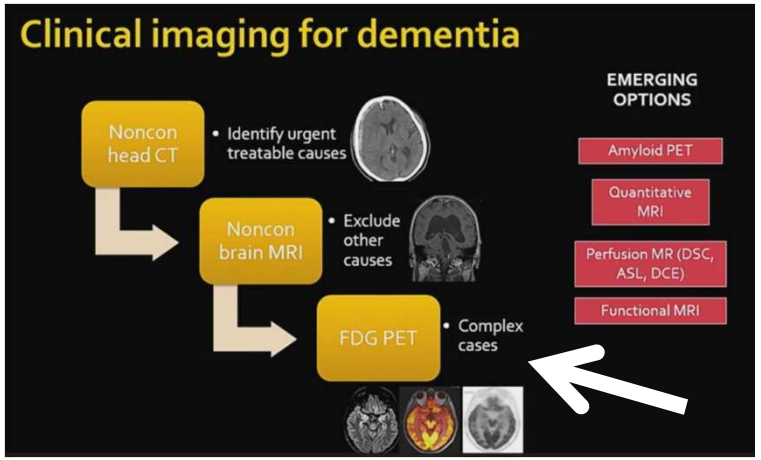
Co-registration de la perfusion ASL avec l'image morphologique T1

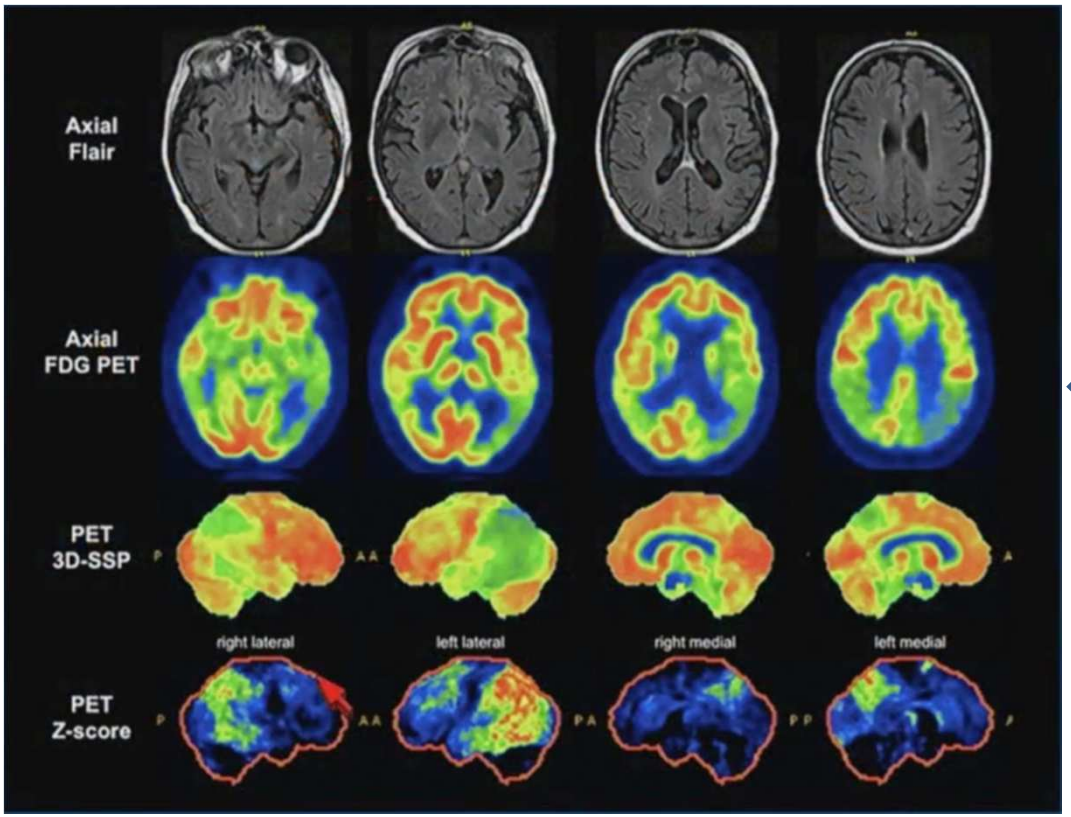




FDG-PET

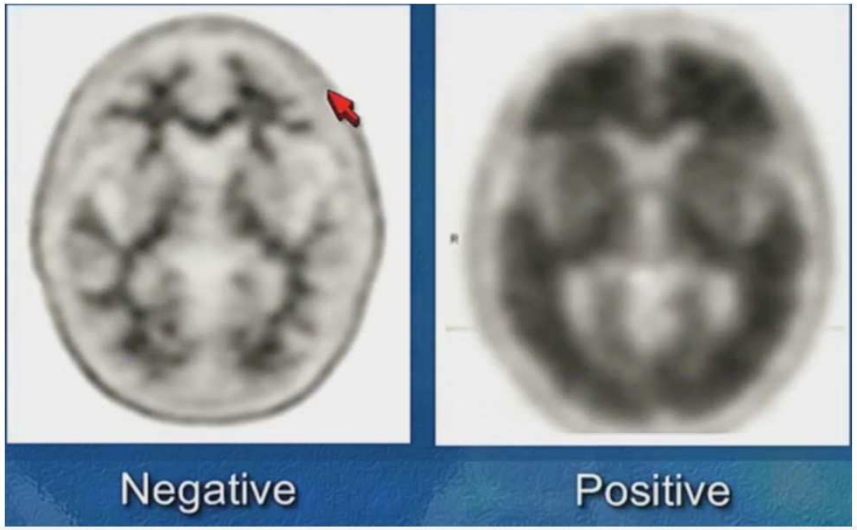
FDG-PET normal

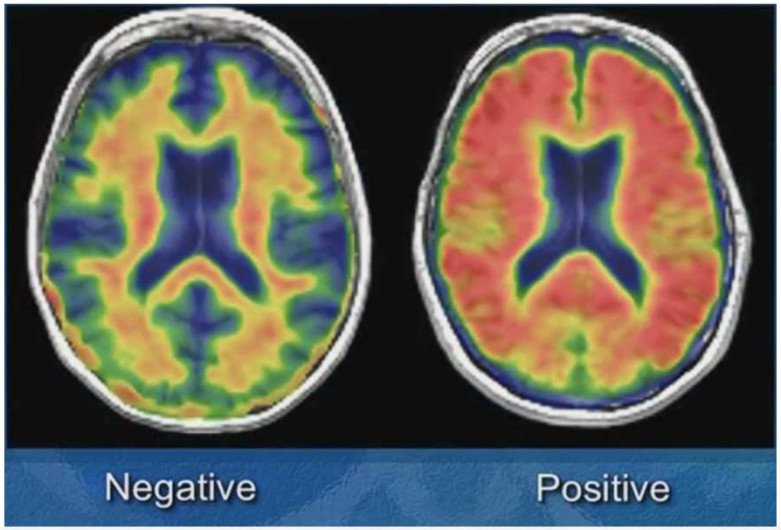


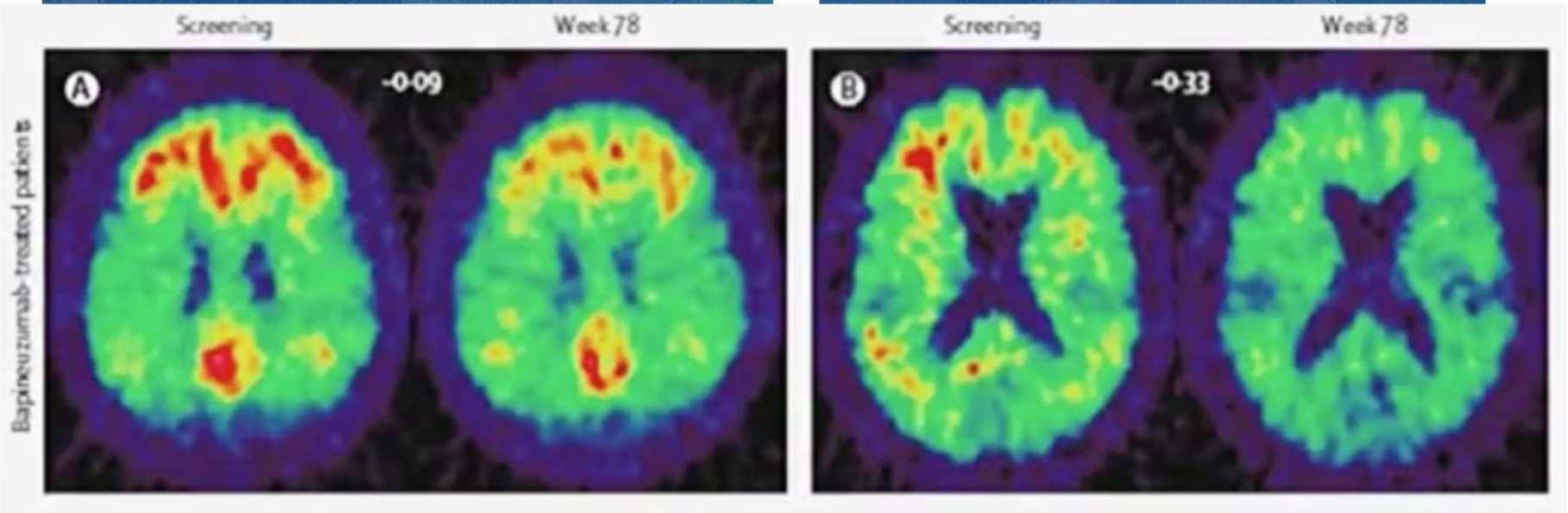


FDG-PET AD

Amyloid PET





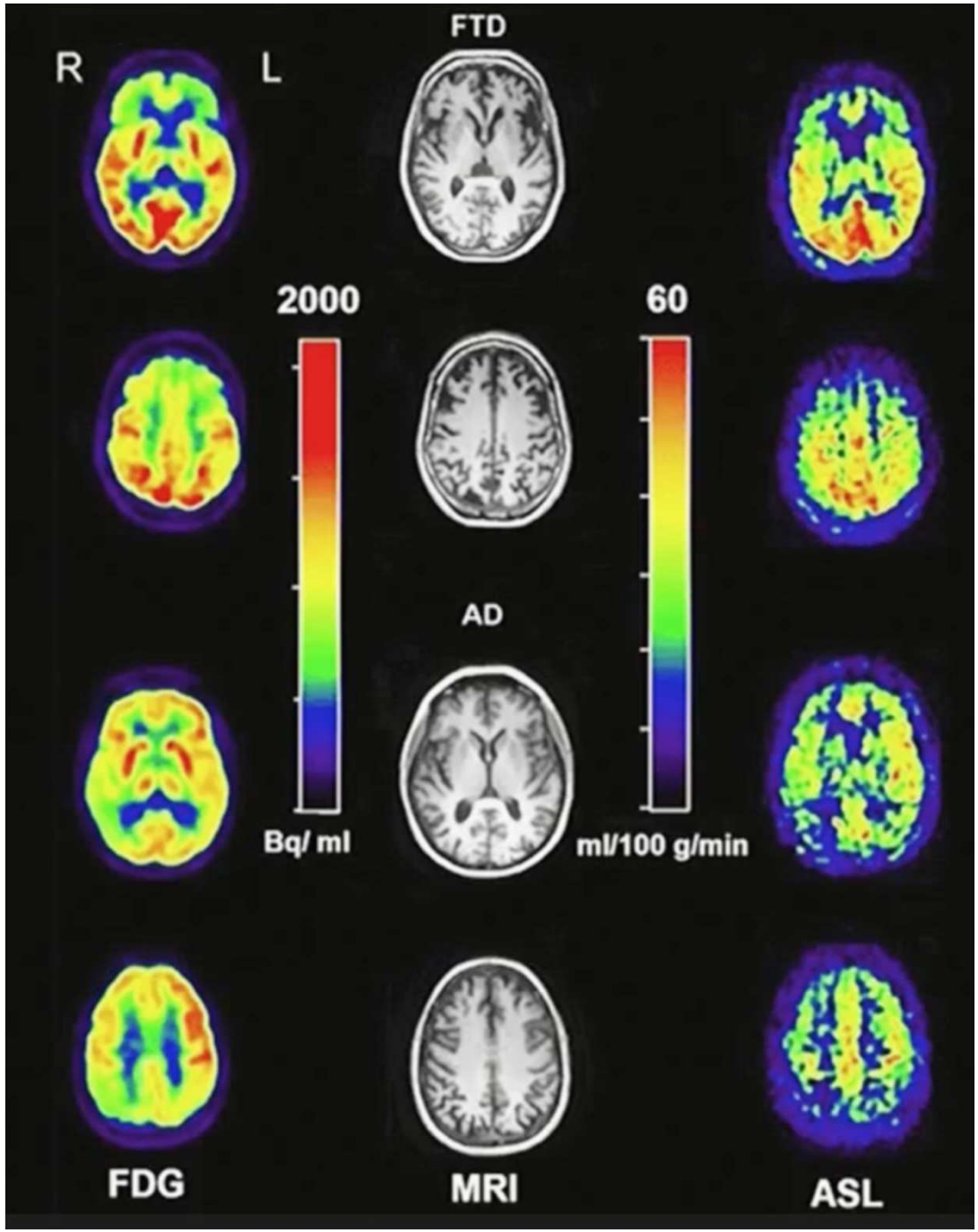


^{11}C-PiB PET assessment of change in fibrillar amyloid-β load in patients with Alzheimer's disease treated with bapineuzumab: a phase 2, double-blind, placebo-controlled, ascending-dose study

Rinne et al. Lancet Neurology 2010;9:363-372

Guidelines UCL Démence

1. Analyse morphologique ‘éclairée’
   (connaissance des entités morphologiques)
2. Analyse quantitative
   1. Scheltens
   2. Volumétrie (sérielle)
3. Intégration ASL



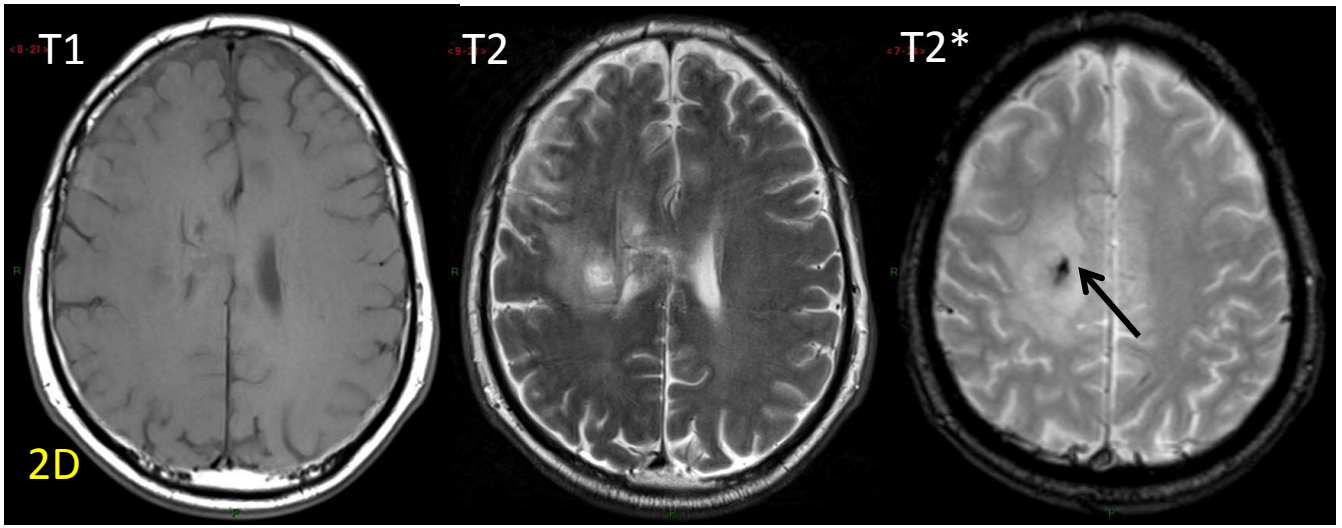
Imagerie des tumeurs cérébrales primaires et secondaires

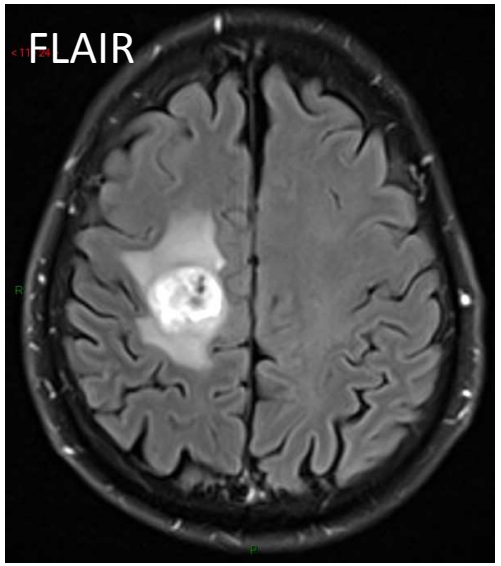
Tumeurs cérébrales primitives

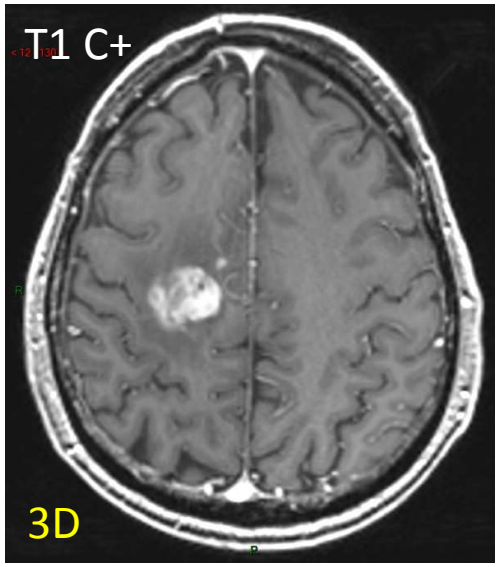
How do we do ?... What should we do ?

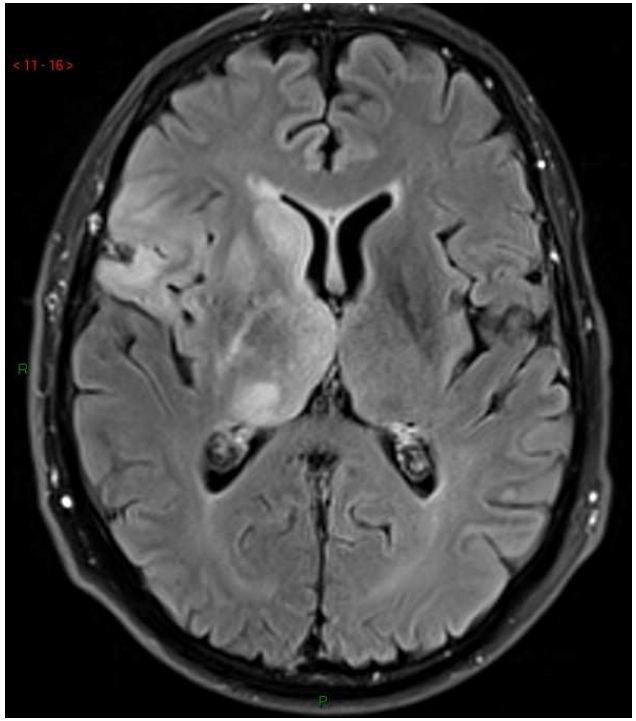
PRE-CONTRAST

POST-CONTRAST

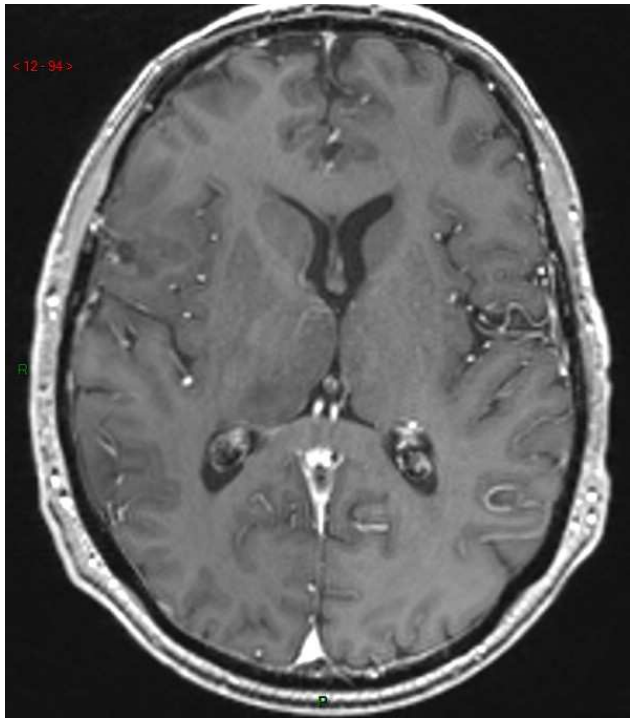




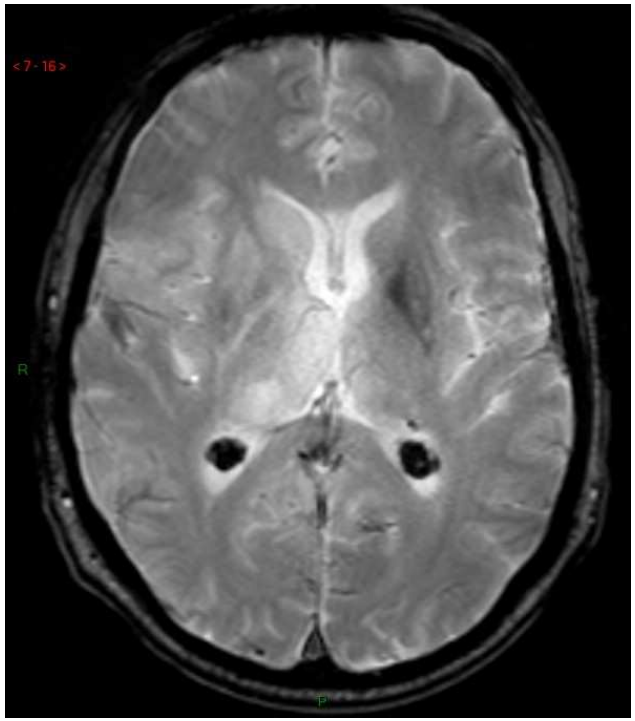




FLAIR



T1 C+



GRE-T2*

The power of ‘basic’ imaging !

1 contingent tumoral qui rehausse (minoritairement)

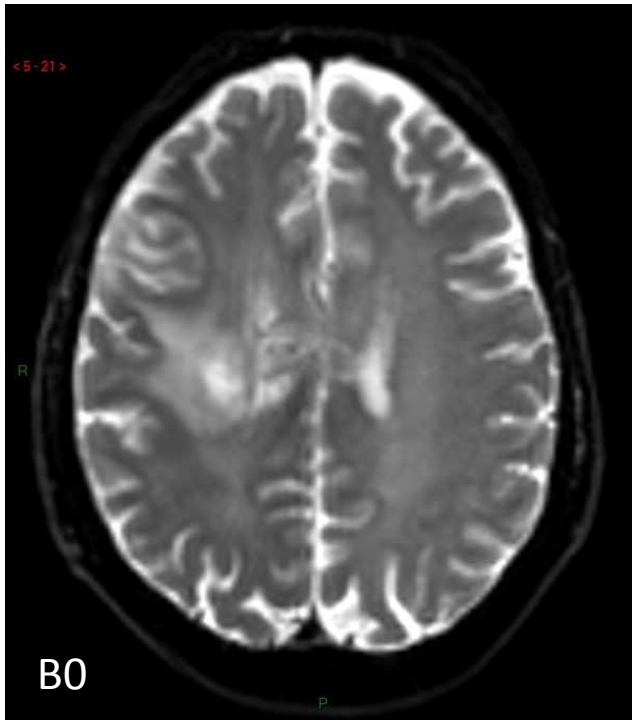
+

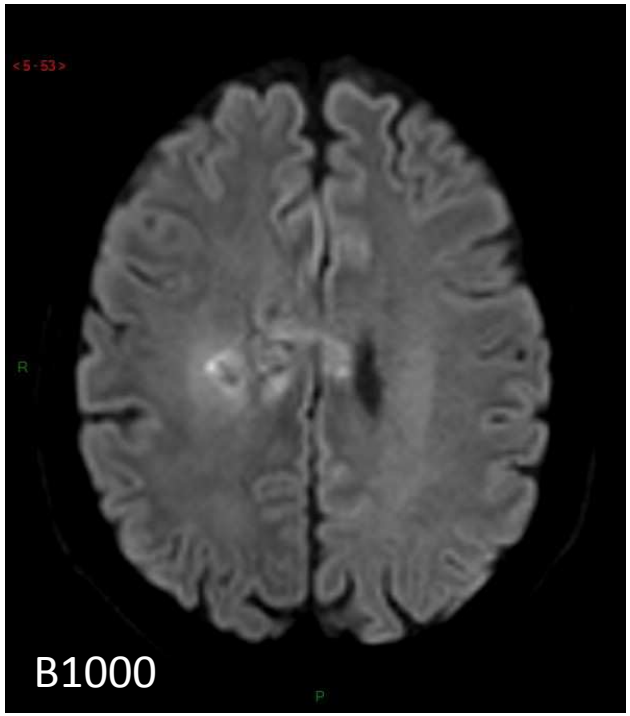
1 contingent tumoral qui ne rehausse pas

=

tumeur primitive = gliome

DWI


B0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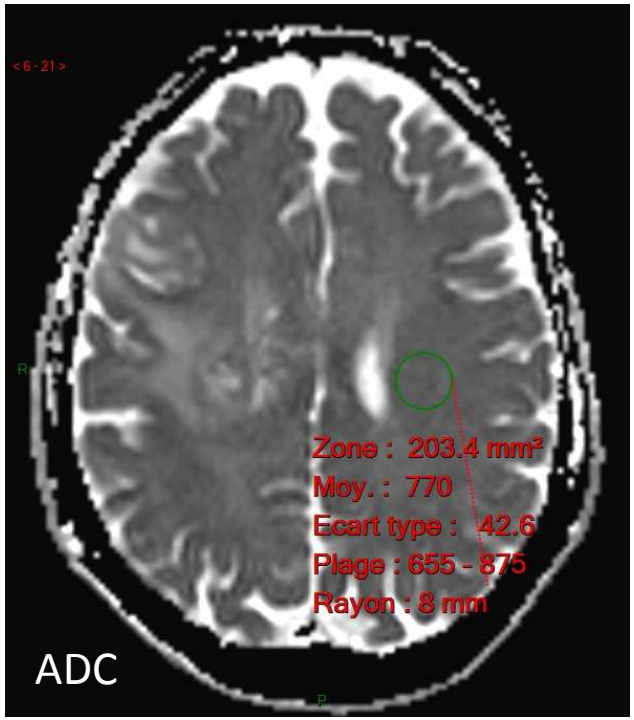
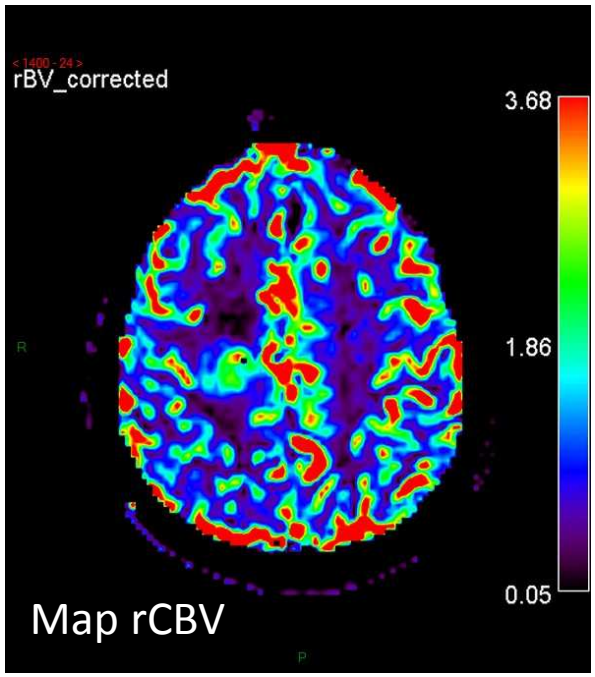
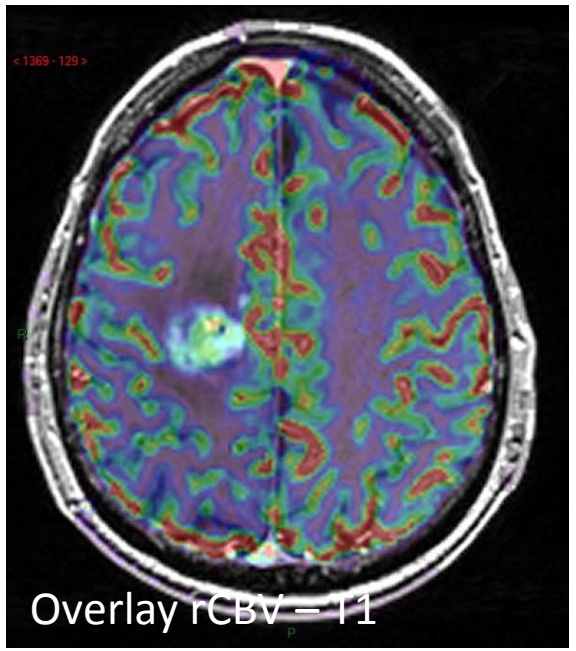
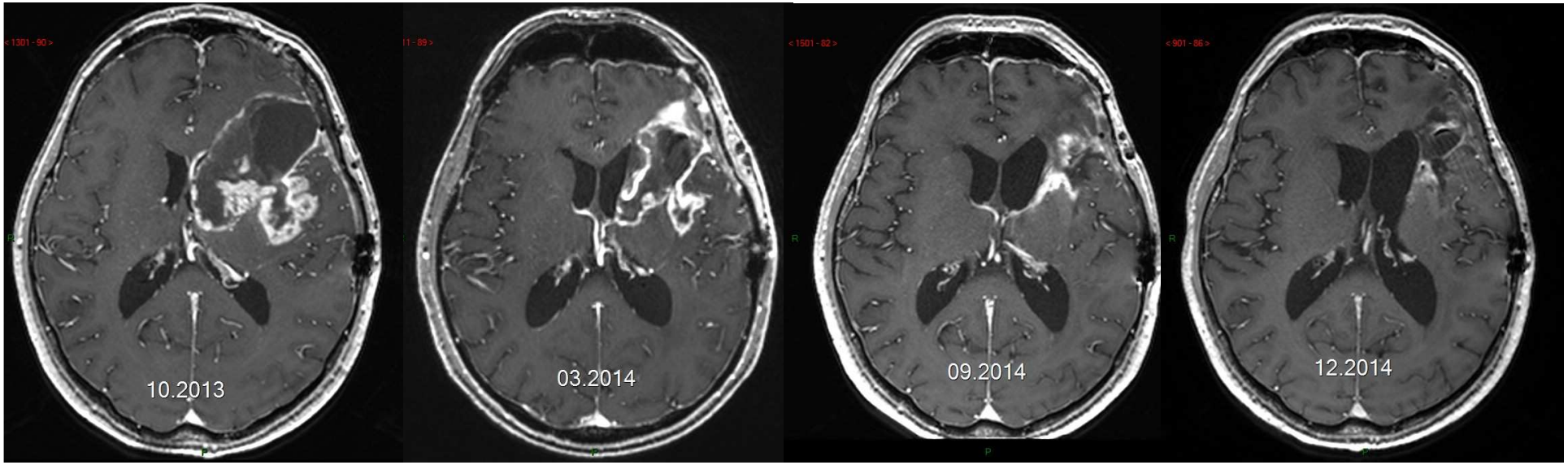

Zone : 203.4 mm²
Moy. : 770
Ecart type : 42.6
Plage : 655 - 875
Rayon : 8 mm
ADC

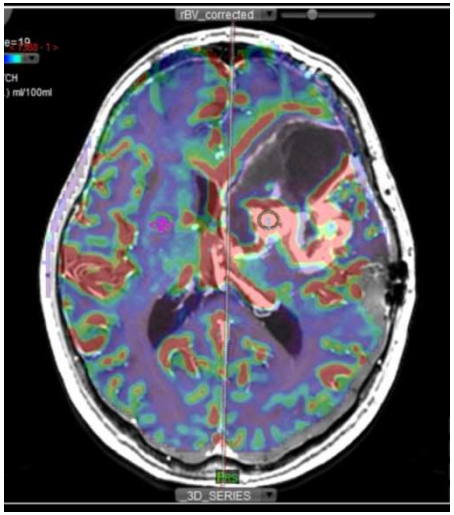
PWI

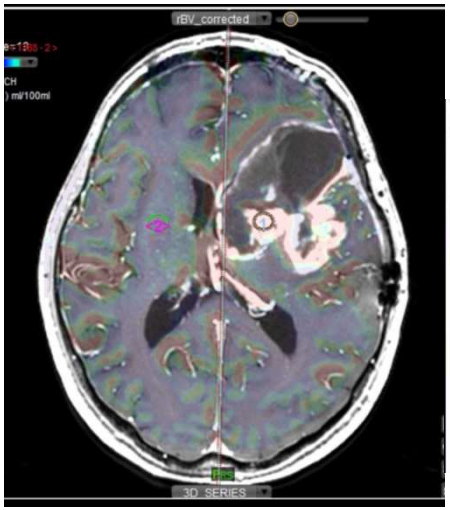

rBV_corrected
3.68
1.86
0.05
Map rCBV


Overlay rCBV – T1

PSEUDO-PROGRESSION







10.2013

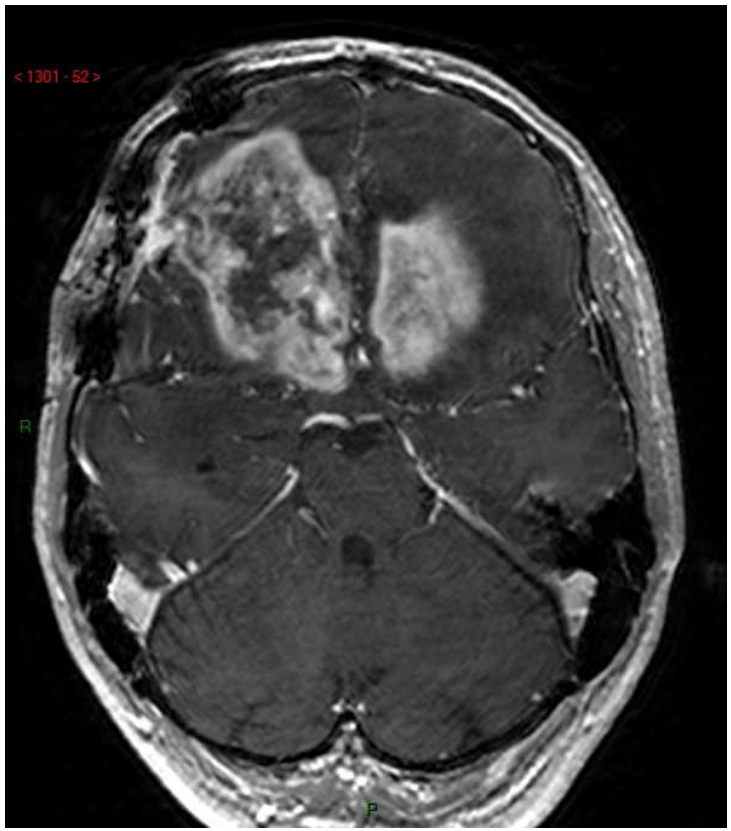
Series	1	<2>
FLAIR	2031.33 [1.99]	1018.79
rBV_corrected	14.14 [9.44]	1.5

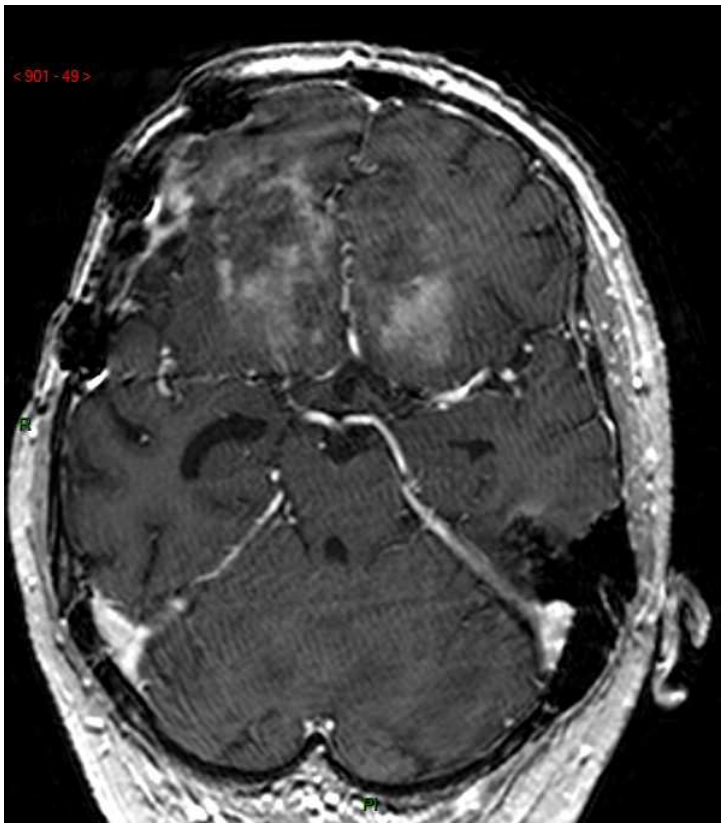
PSEUDO-REGRESSION

14.03.2011

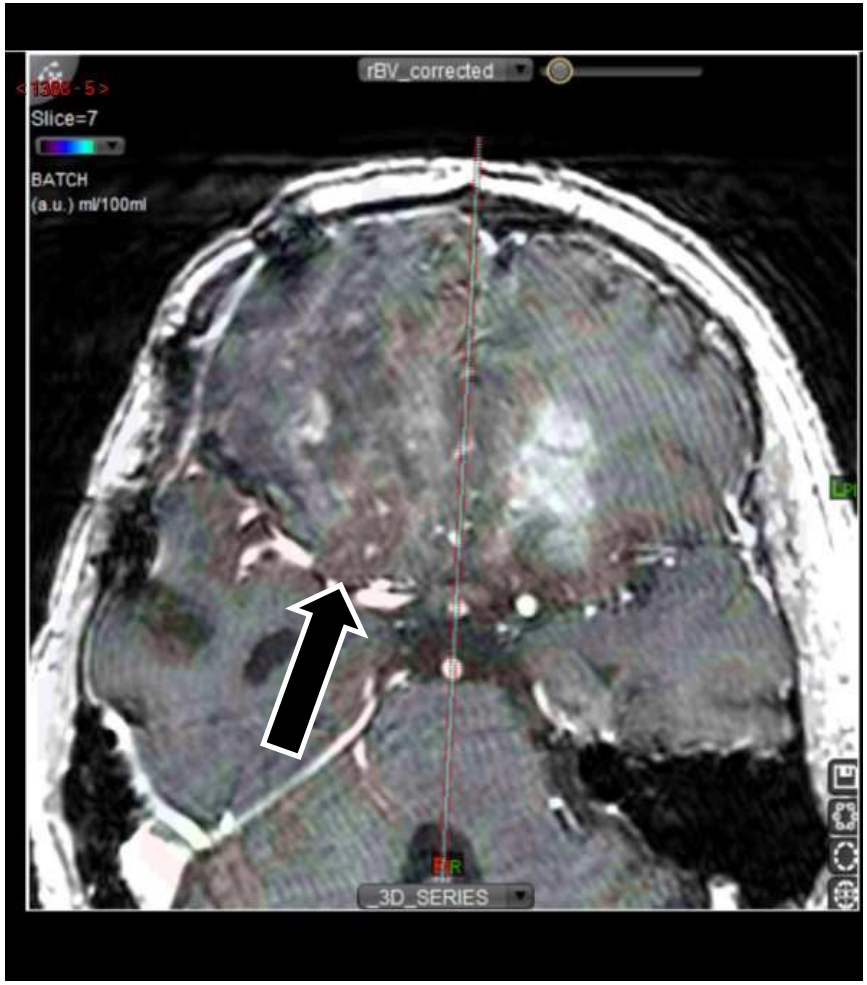
15.06.2011

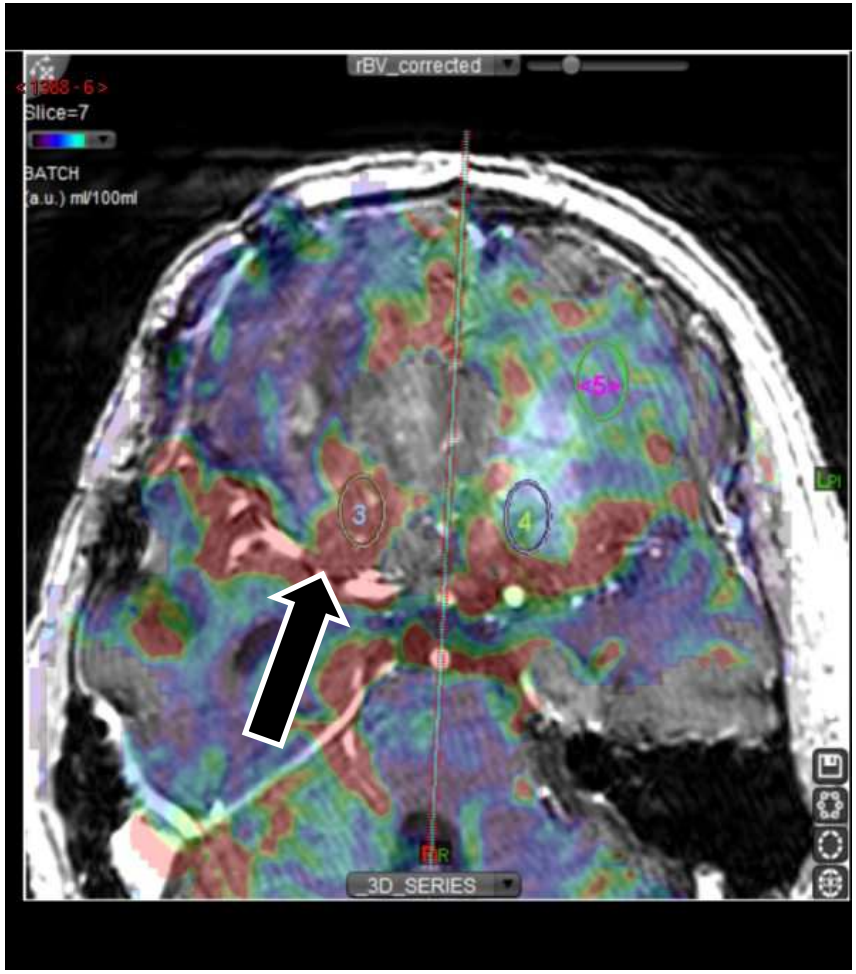
18.09.2011





Becacizumab
AVASTIN ®





15.06.2011

Series	3	4	<5>
FLAIR	2101.28 [1.67]	1768.51 [1.4]	1260.51
rBV_corrected	4.44 [3.39]	1.7 [1.29]	1.31

Biomarqueur

*prédictif de réponse thérapeutique

* démonstratif de réponse thérapeutique

Radiologique ?

Métabolique ?

Génétique ?

Autre ?...

Mutation IDH_1 IDH_2

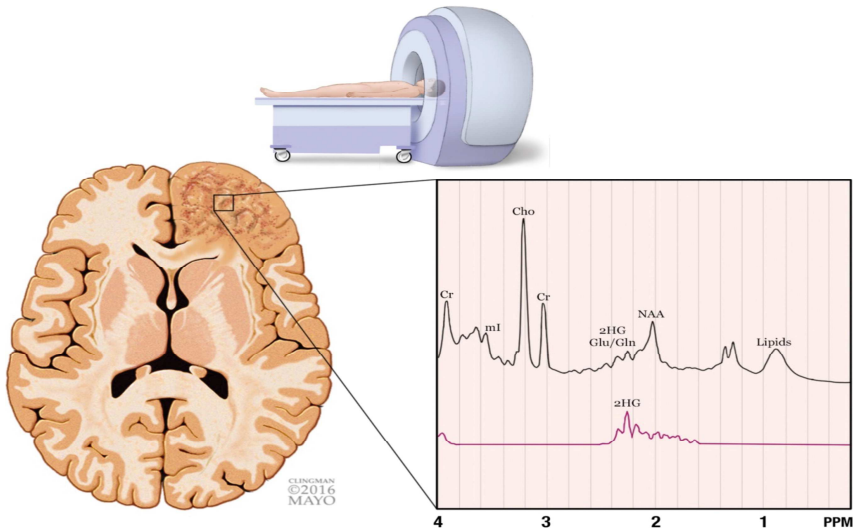
Enzyme : isocitrate déshydrogénase

Cycle de Krebs

→ Mutation → accumulation de 2HG (2 OH-Glutarate)

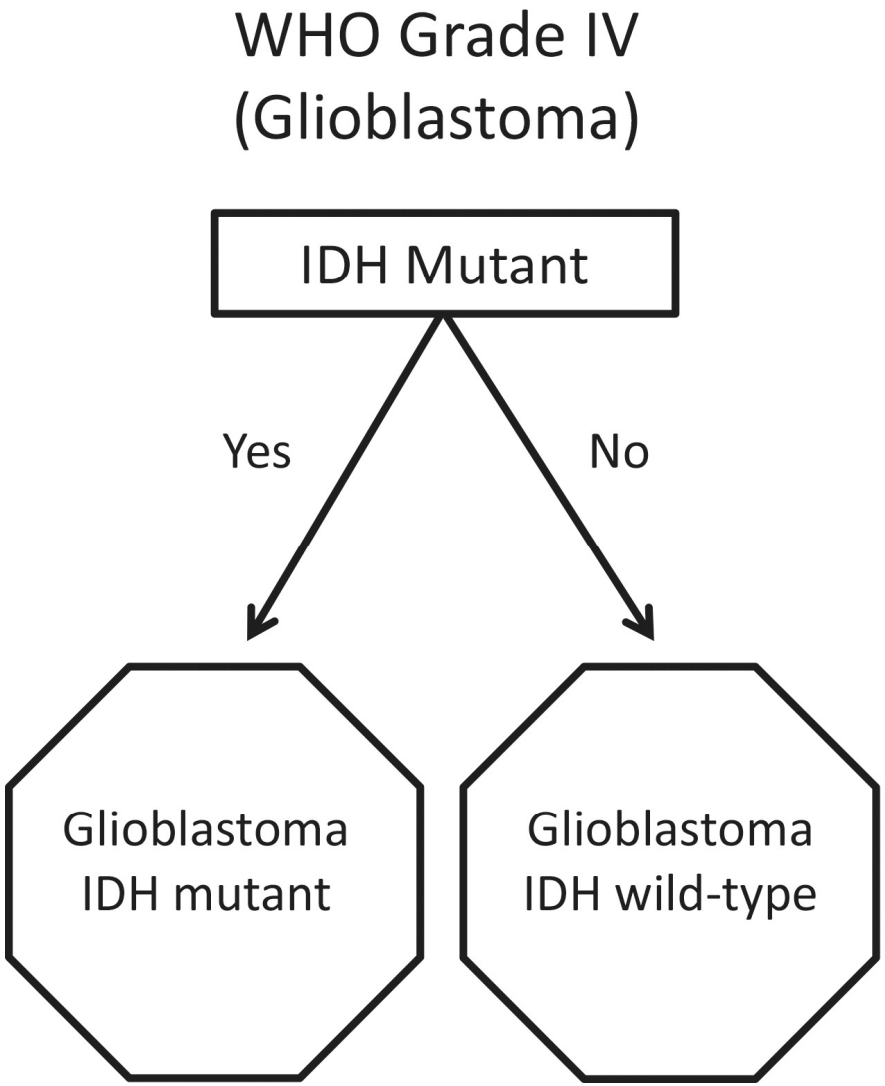
→ Typeur diagnostique

→ Prédicteur de réponse thérapeutique



2HG = oncométabolite

Détectable par spectroscopie protonique ‘simple’



Glioblastoma, IDH mutant

- ~10% of GBMs
- Younger median age at diagnosis
- Better prognosis
- More likely to be *MGMT* methylated
- Most "secondary" GBMs
- IDH mutation is possible target for therapeutic agents (trials ongoing)

Glioblastoma, IDH wild-type

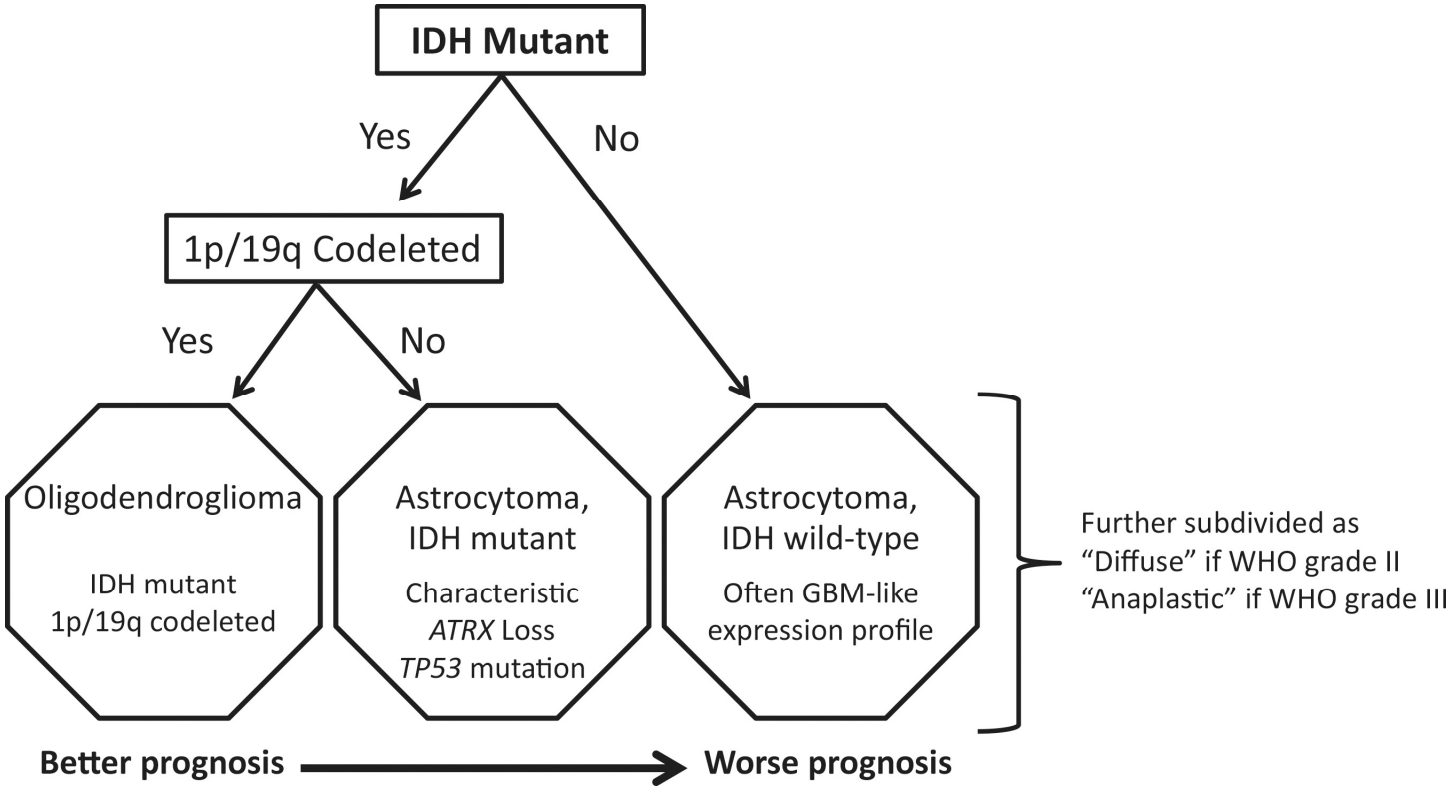
- ~90% of GBMs
- Older median age at diagnosis
- Poorer prognosis
- Most "primary" GBMs

Codélétion 1p19q

Translocation entre le bras p du chromosome 1 et le bras q du chromosome 19

→ Typeur diagnostique

→ Prédicteur de réponse thérapeutique

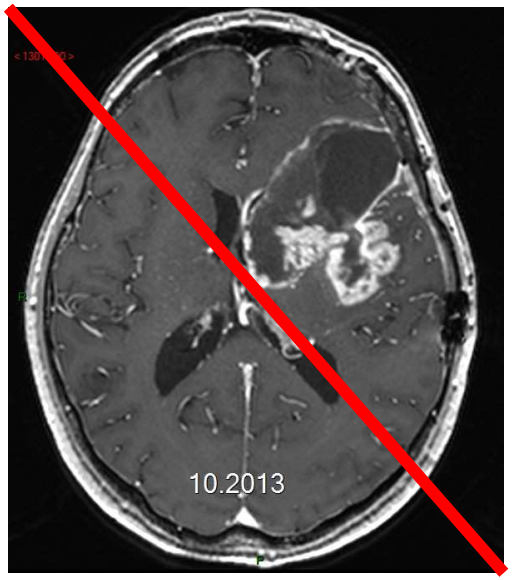


Méthylation du promoteur du gène MGMT

Gène qui code pour une enzyme: Methyl Guanine DNA MethylTransferase
= gène de réparation du DNA
qui a un gène promoteur *'silenced'* par méthylation
→ sensibilité accrue aux agents alkylants dont Temozolomide (Temodal®)

Prédicteur de sensibilité à une thérapeutique spécifique

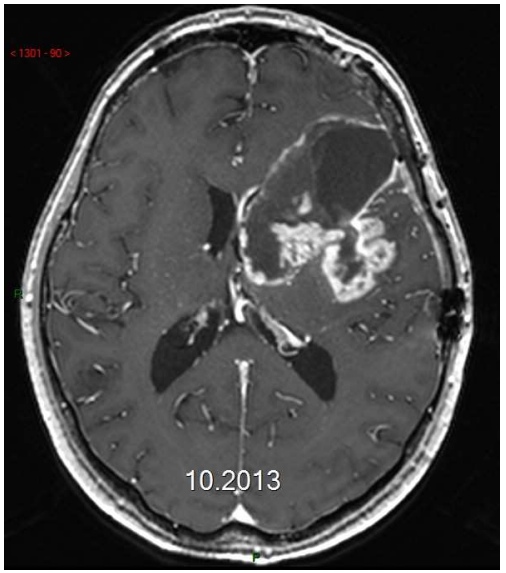
Marqueur de risque à faire une pseudo-progression



Promoteur MGMT méthylé

=

Pseudo-progression



Promoteur MGMT NON méthylé

=

progression

New brain tumor classification system **WHO 2016** (1st Edition 1979)

Diagnostic d'une tumeur:

- Morphologique (microscope)
- Génétique
- Moléculaire

Élimination d'entités majeures : oligoastrocytome / PNET / gliomatose cerebri
Définitions de nouvelles entités:
Restructuration des gliomes:

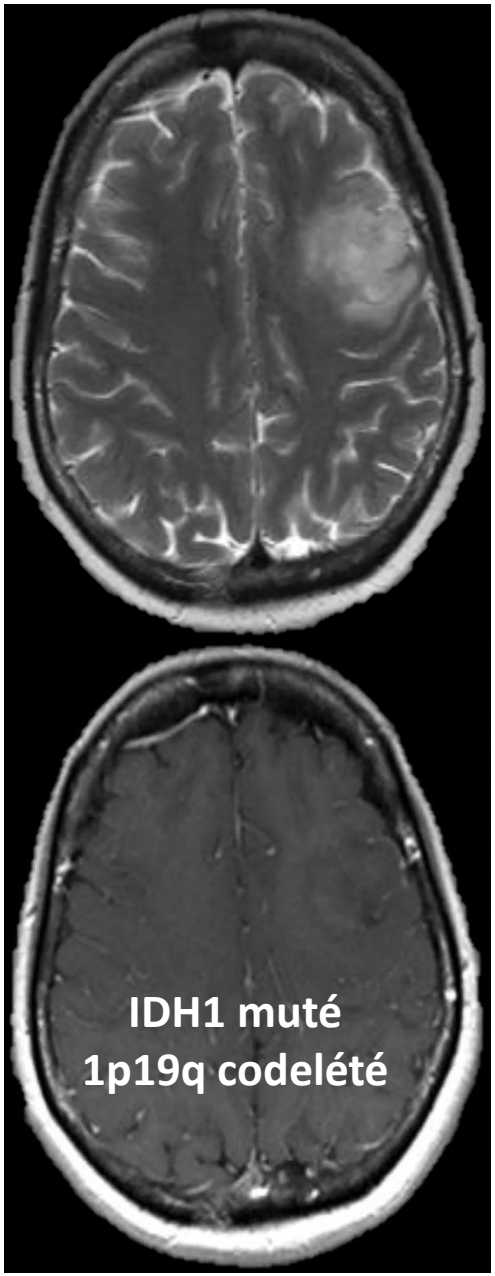
- Astrocytomes → plus agressifs et moins RT-sensibles
- Oligodendrogliomes → moins agressifs et plus sensibles au R/
- Oligoastrocytomes → intermédiaires

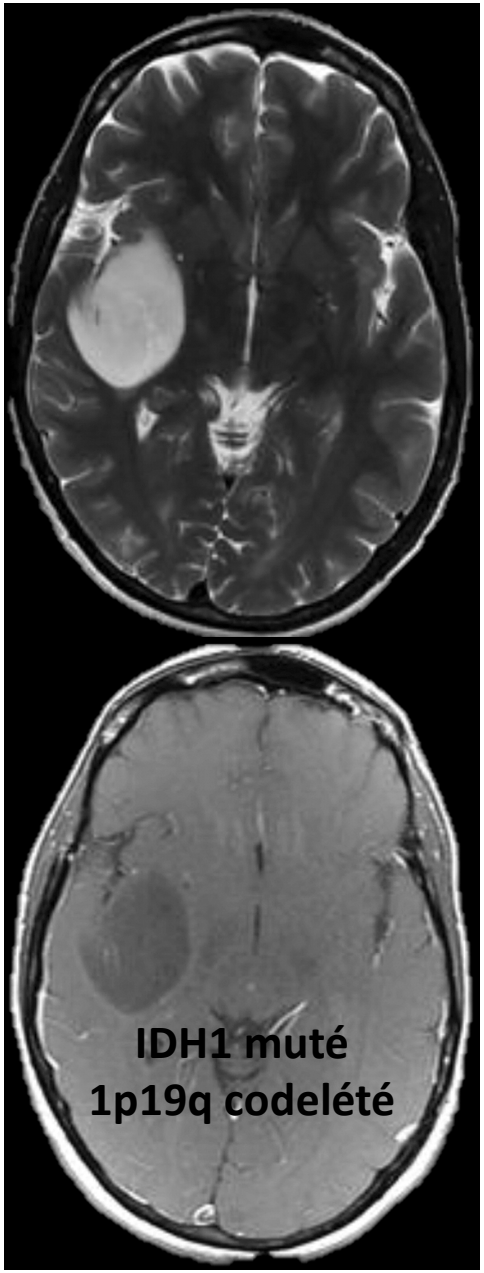
Diagnostic OA: NOS (not otherwise specified) ssi mutation IDH et codeletion 1p19q failed)
et cellularité mixte au microscope

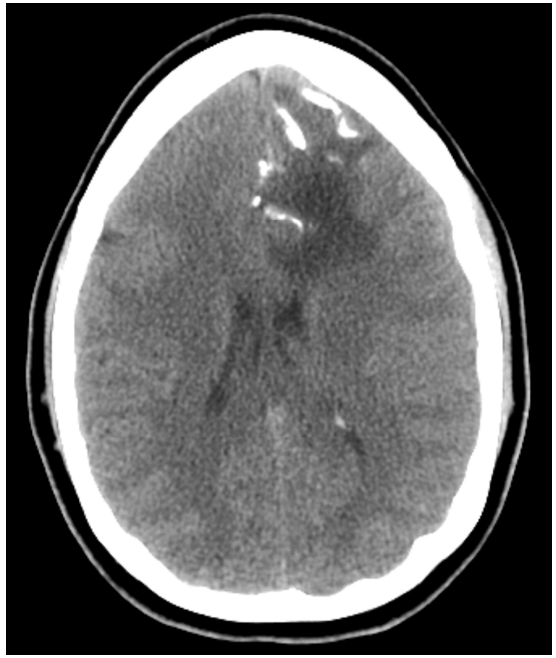
Re-définition des stratégies thérapeutiques

- TMZ efficace si GBM IDH1 muté
- Efficacité de RT suivi de PCV efficace sur les grades II et III codelétés (oligo)

→ Split : * 1p19q (-) → TMZ
* 1p19q (+) → PCV







Calcifications = oligodendrogliome

Contours nets

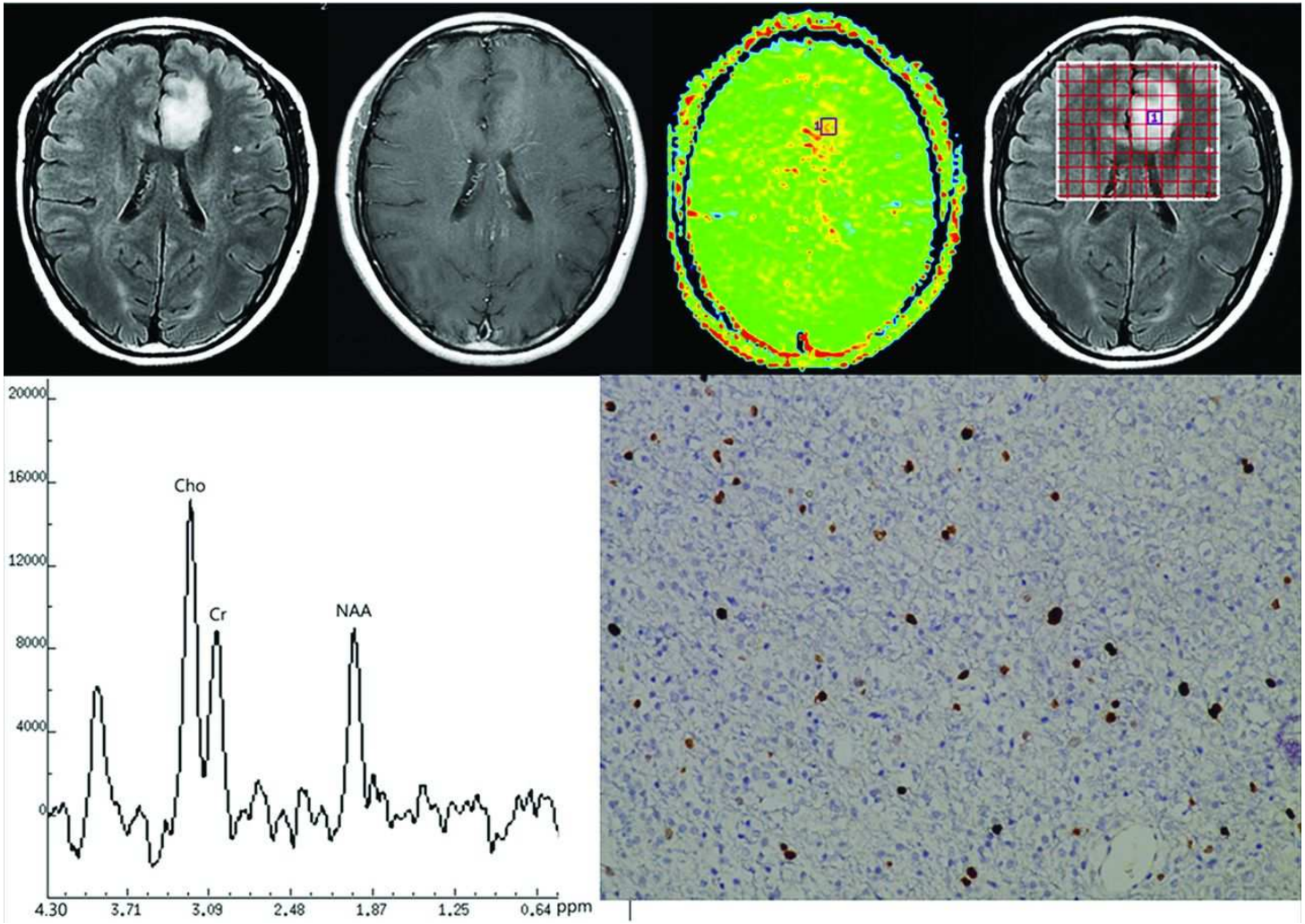
Homogénéïté

Juxta-corticalité/infiltartion corticale

Absence de prise de contraste

Encore une place pour l'imagerie morphologique !

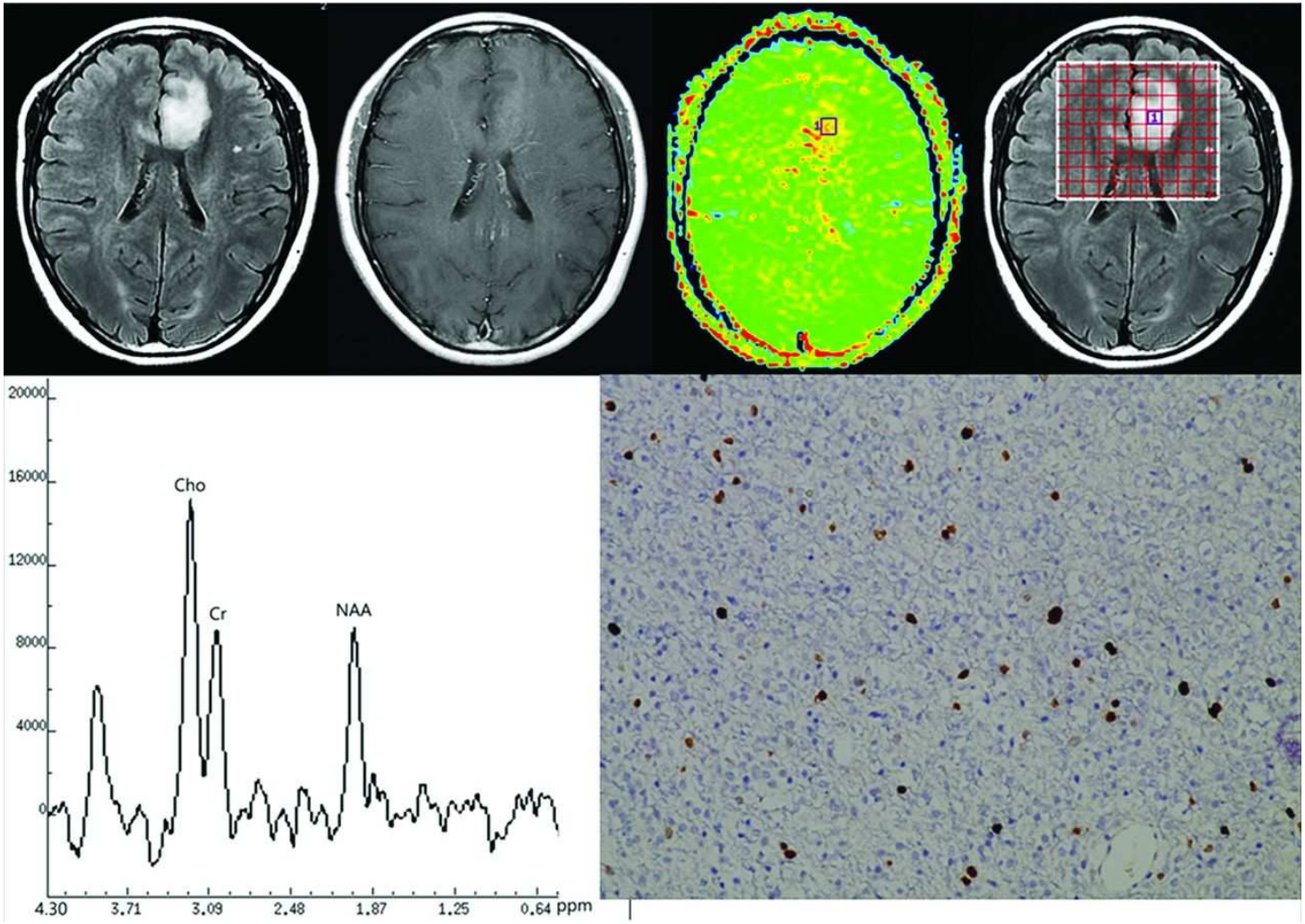
APT: tumeur low-grade



C. Su et al. AJNR Am J Neuroradiol 2017;38:1702-1709

AJNR
AMERICAN JOURNAL OF NEURORADIOLOGY

APT: tumeur high-grade

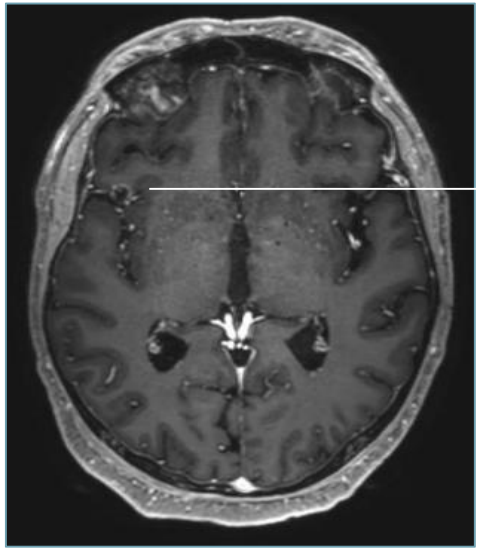


C. Su et al. AJNR Am J Neuroradiol 2017;38:1702-1709

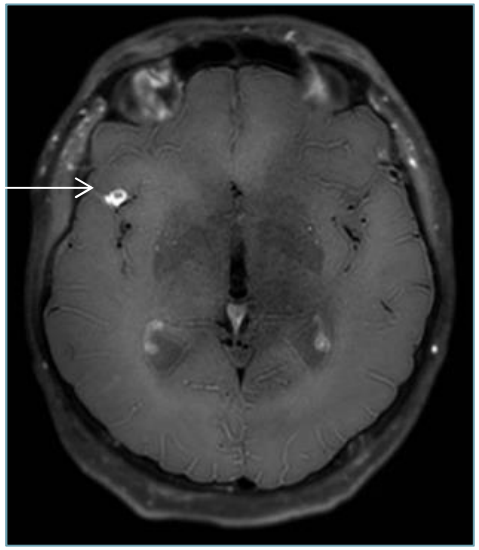
AJNR
AMERICAN JOURNAL OF NEURORADIOLOGY

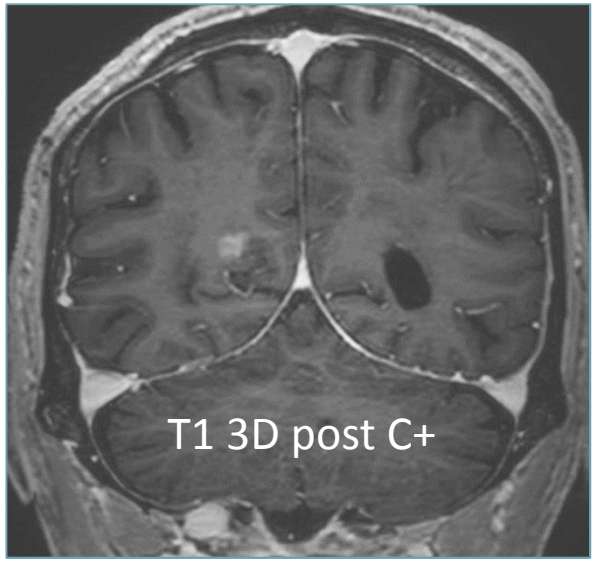
Tumeurs cérébrales secondaires: progrès technologique

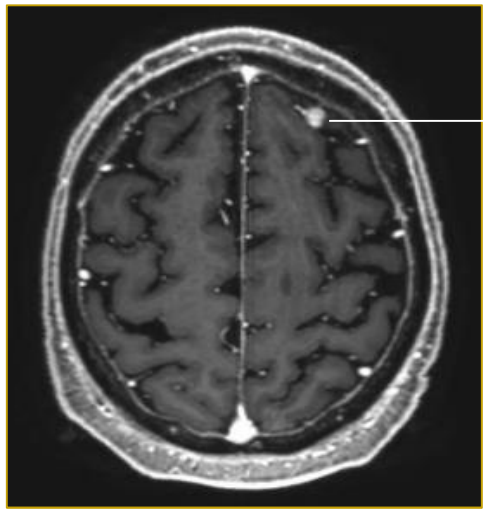
T1 3D post C+



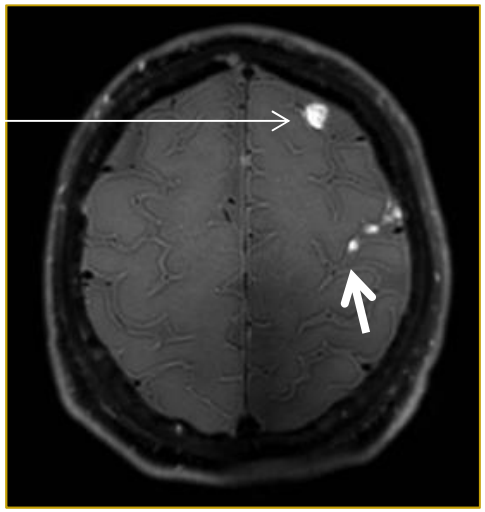
Black Blood T1 post C+



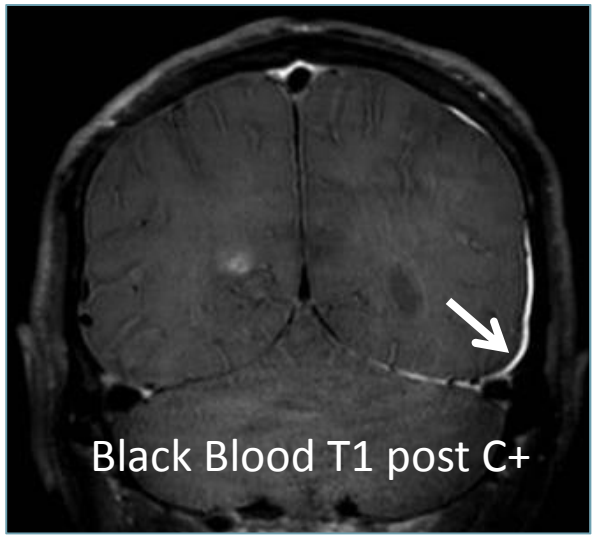




T1 3D post C+



Black Blood T1 post C+



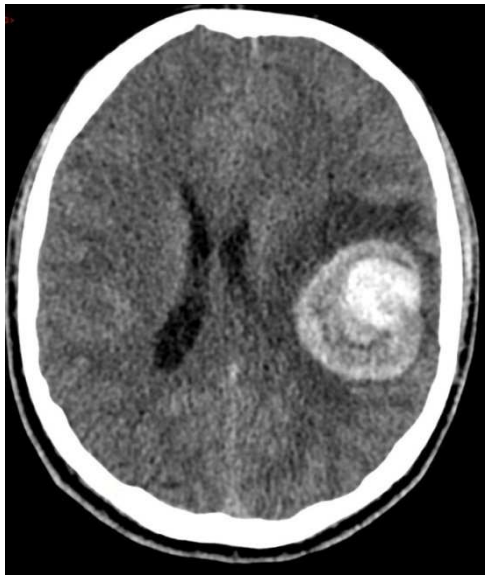
Courtesy of Prof Dr Jan Casselman, M.D., Ph.D.

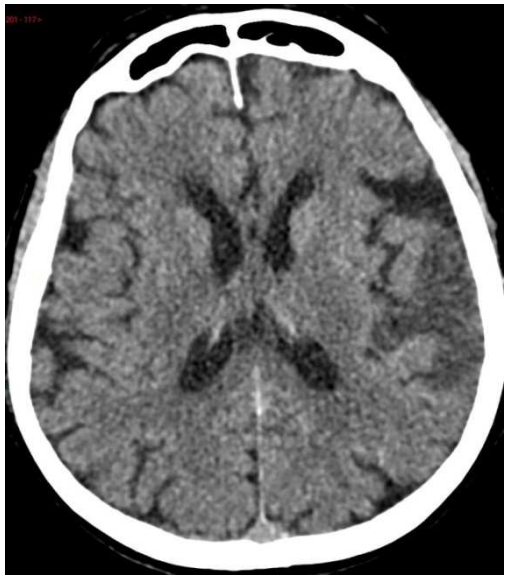
Guidelines et perspectives tumeurs cérébrales

- Bien maîtriser l'imagerie morphologique
- Se choisir un biomarqueur 'familier': DWI – PWI – MRS
- Incorporer les données de la génétique moléculaire
- S'informer des nouveaux bio-marqueurs à venir
- Appliquer l'APT aux tumeurs primitives après validation
- Appliquer le BB aux tumeurs secondaires

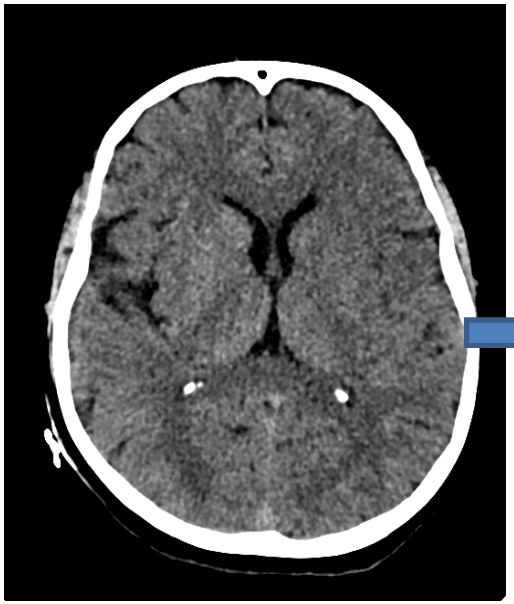
MANAGEMENT du STROKE

NCCT

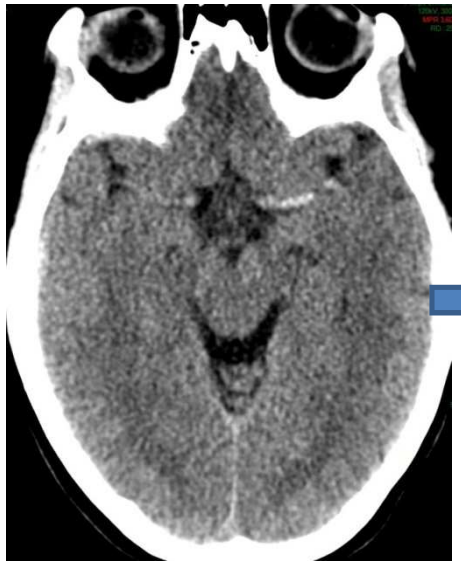




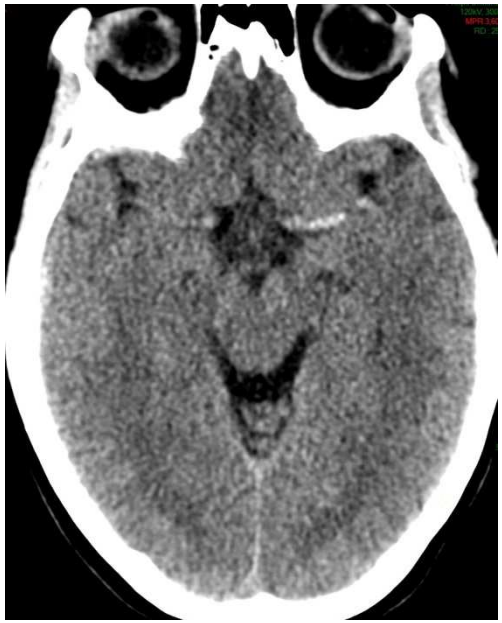
Thrombolyse
Thrombectomie



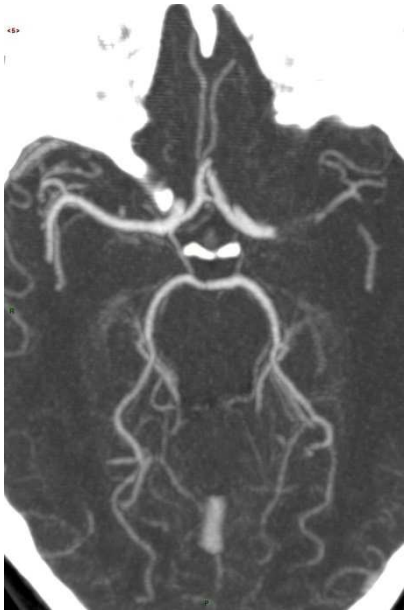
Thrombolyse ssi <4h30



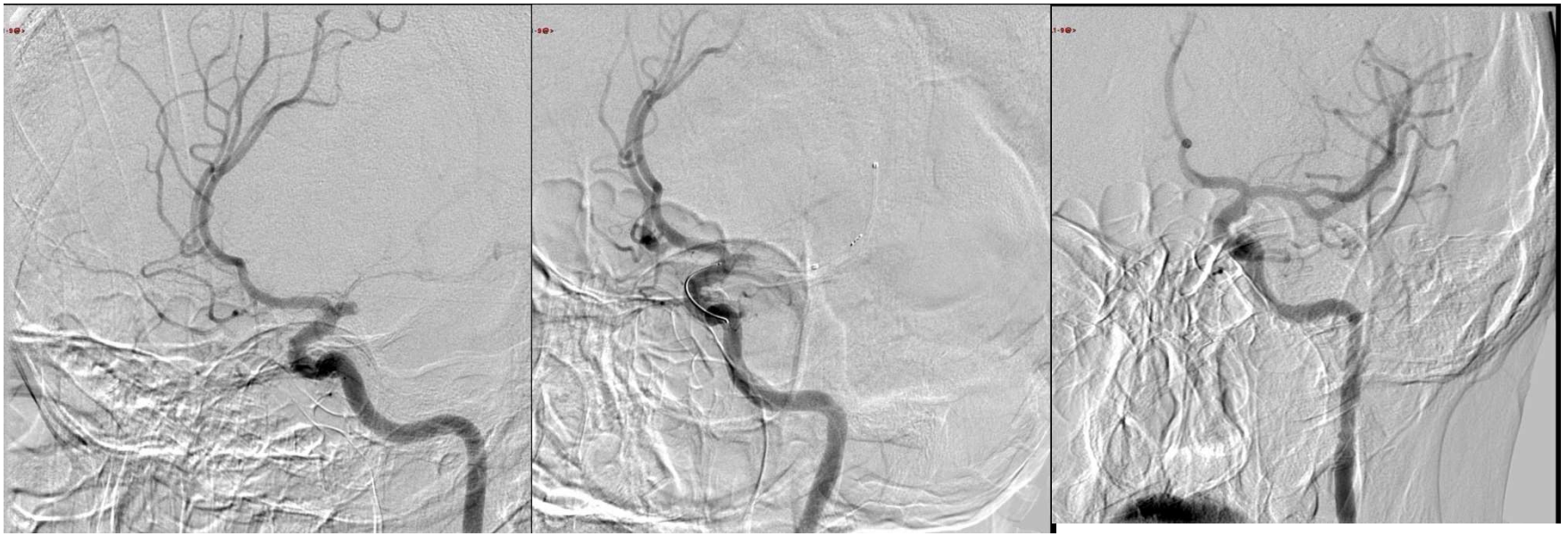
Thombectomie ssi…

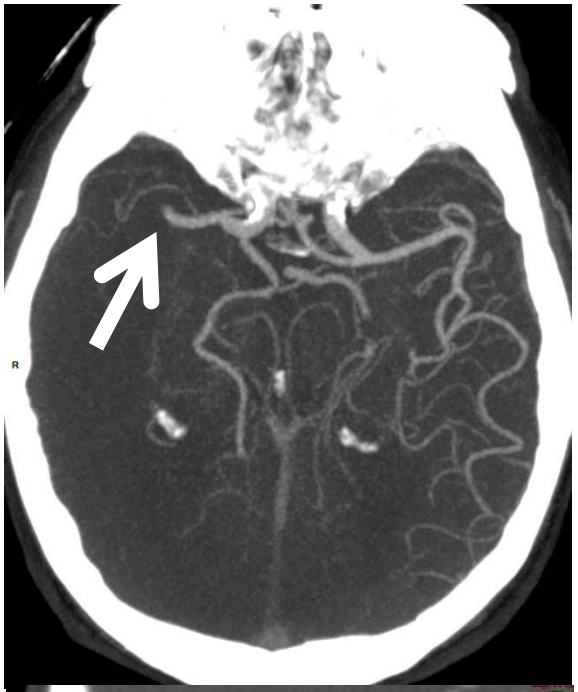


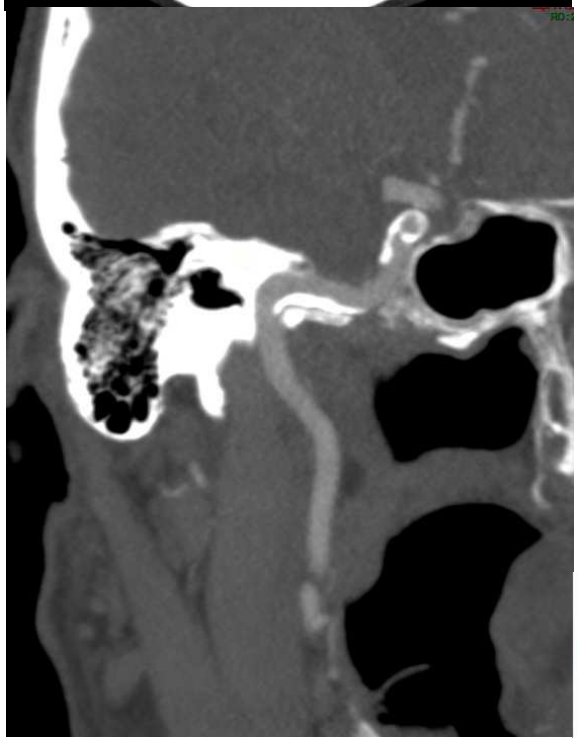
CTA



Caillot proximal
Caillot court







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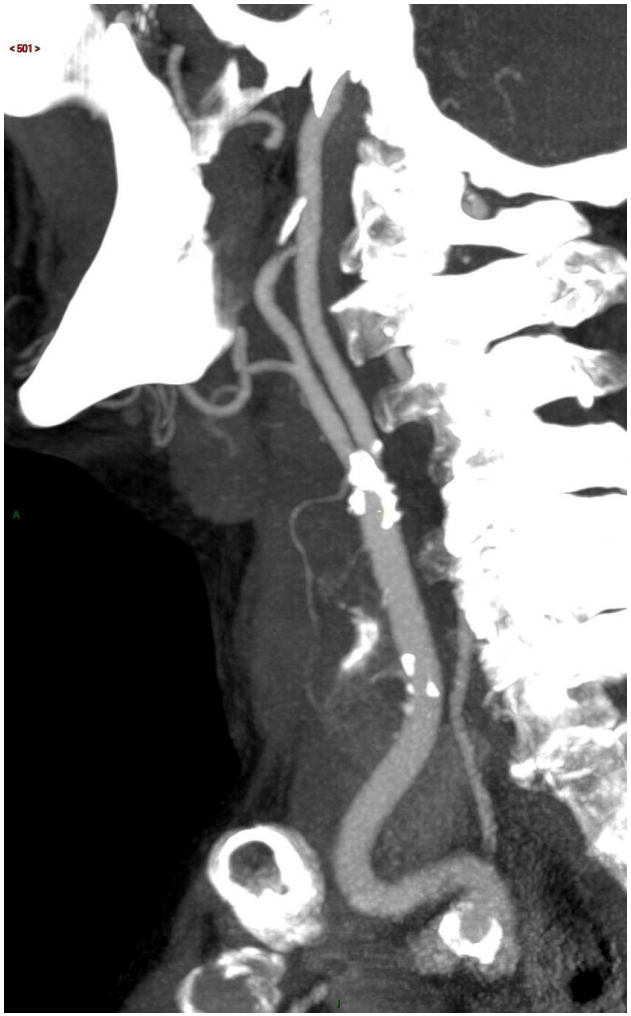
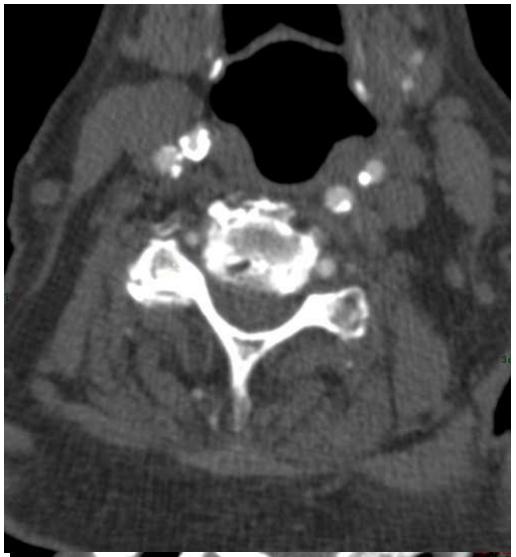
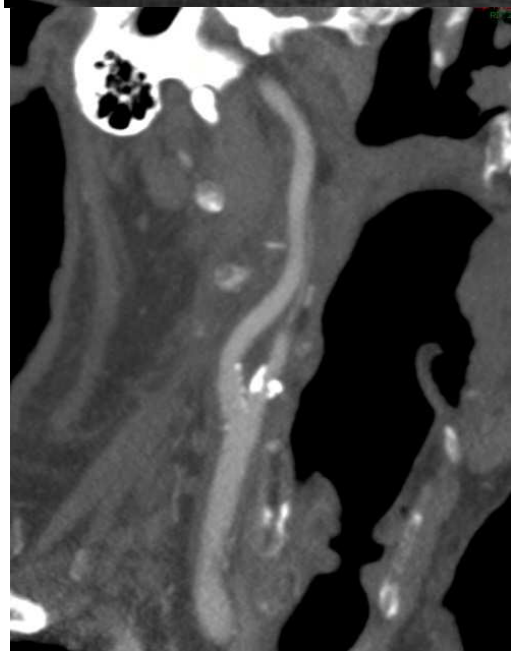
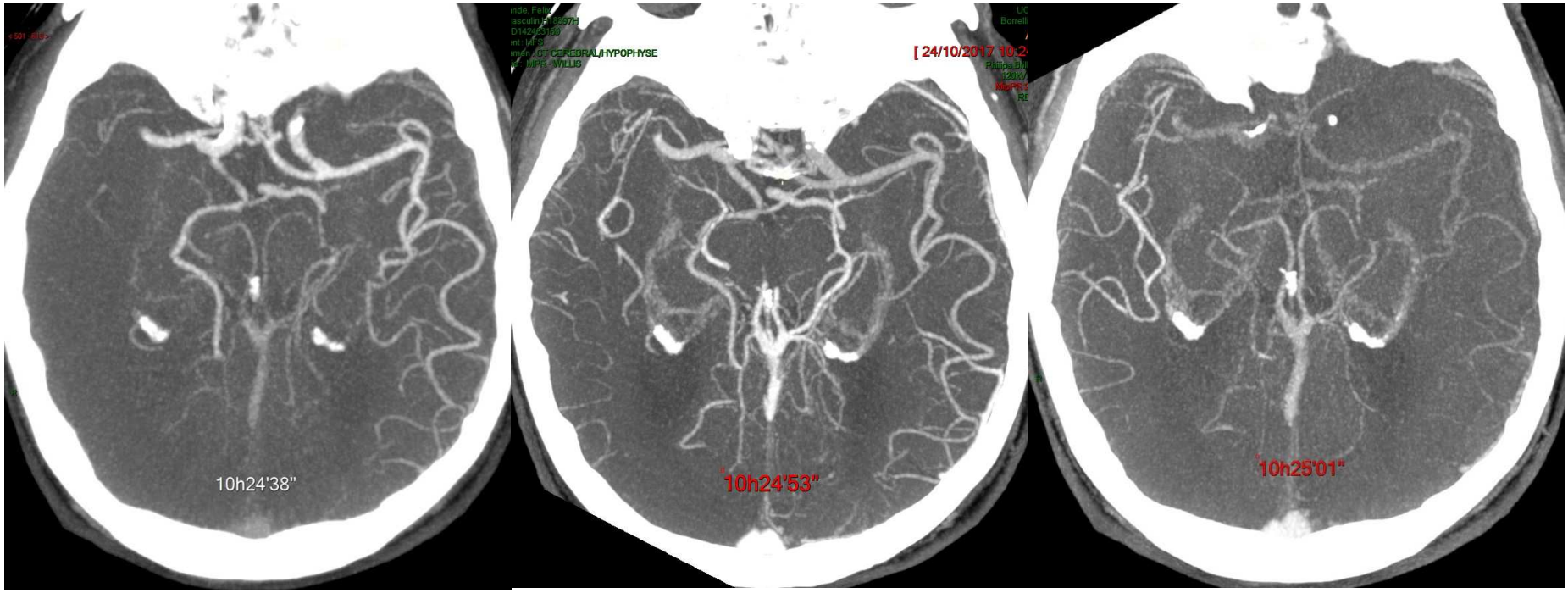






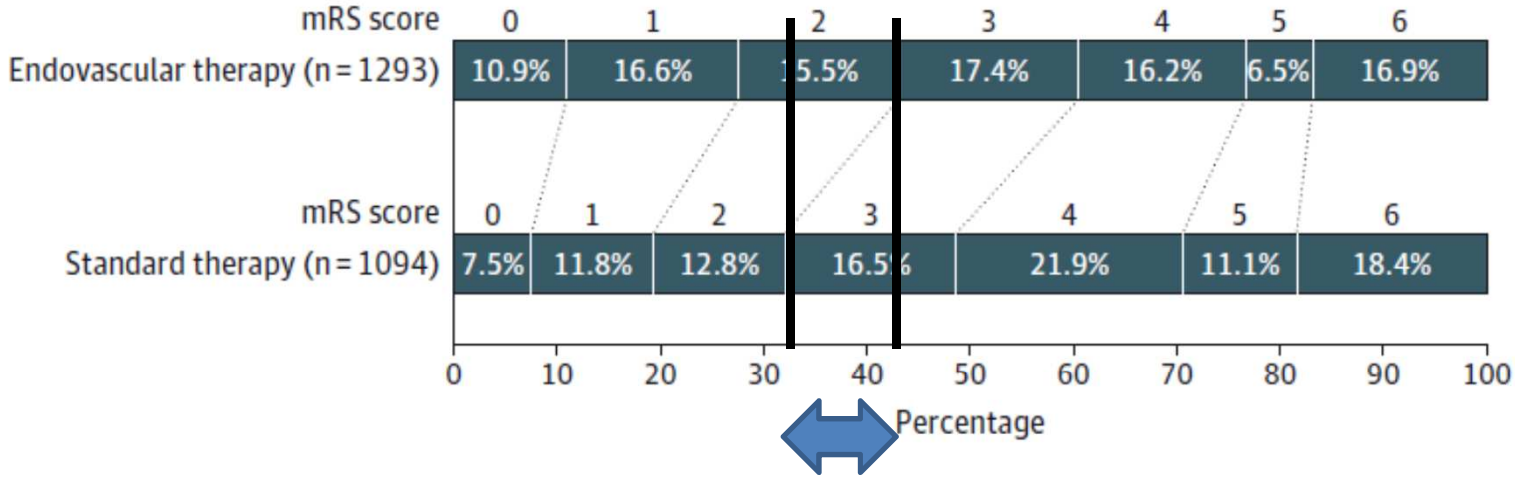
Montrer la perméabilité de la voie endo-vasculaire

CTA … triphasique



Monter la collatéralité → renforce l'indication de thrombectomie surtout ***'hors'*** délai

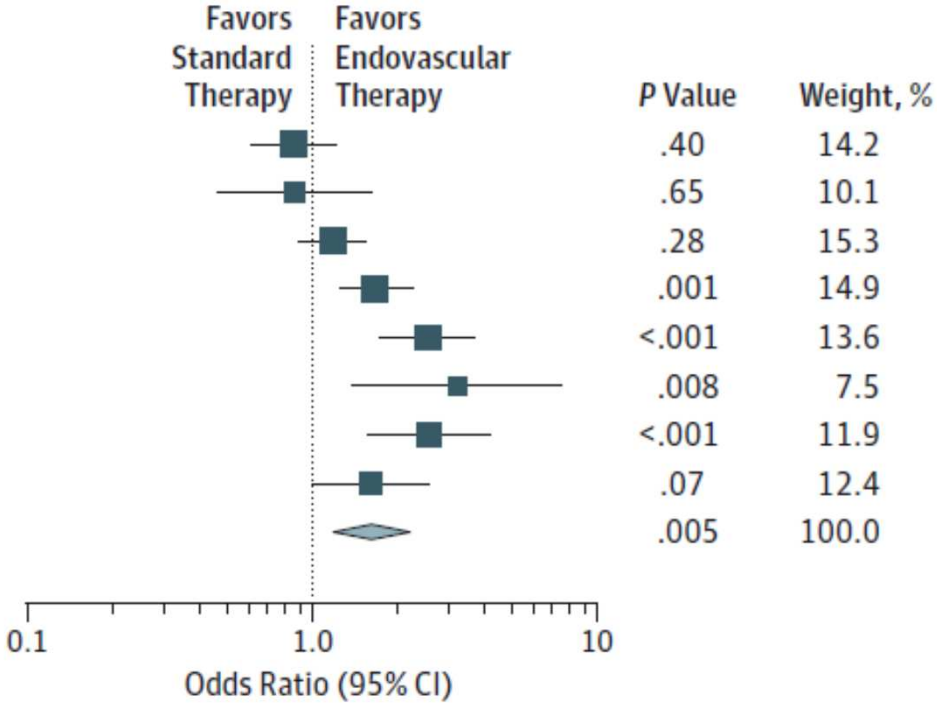
A Degree of disability at 90 d (modified Rankin Scale [mRS])



B Reduced disability at 90 d

Source	Odds Ratio (95% CI)	P Value	Weight, %
SYNTHESIS,[26] 2013	0.86 (0.60-1.23)	.40	14.2
MR RESCUE,[27] 2013	0.86 (0.45-1.63)	.65	10.1
IMS III,[28] 2013	1.17 (0.88-1.57)	.28	15.3
MR CLEAN,[29] 2015	1.66 (1.22-2.28)	.001	14.9
ESCAPE,[30] 2015	2.53 (1.70-3.79)	<.001	13.6
EXTEND-IA,[31] 2015	3.22 (1.36-7.61)	.008	7.5
SWIFT-PRIME,[32] 2015	2.55 (1.53-4.26)	<.001	11.9
REVASCAT,[33] 2015	1.57 (0.97-2.55)	.07	12.4
Overall	1.56 (1.14-2.13)	.005	100.0

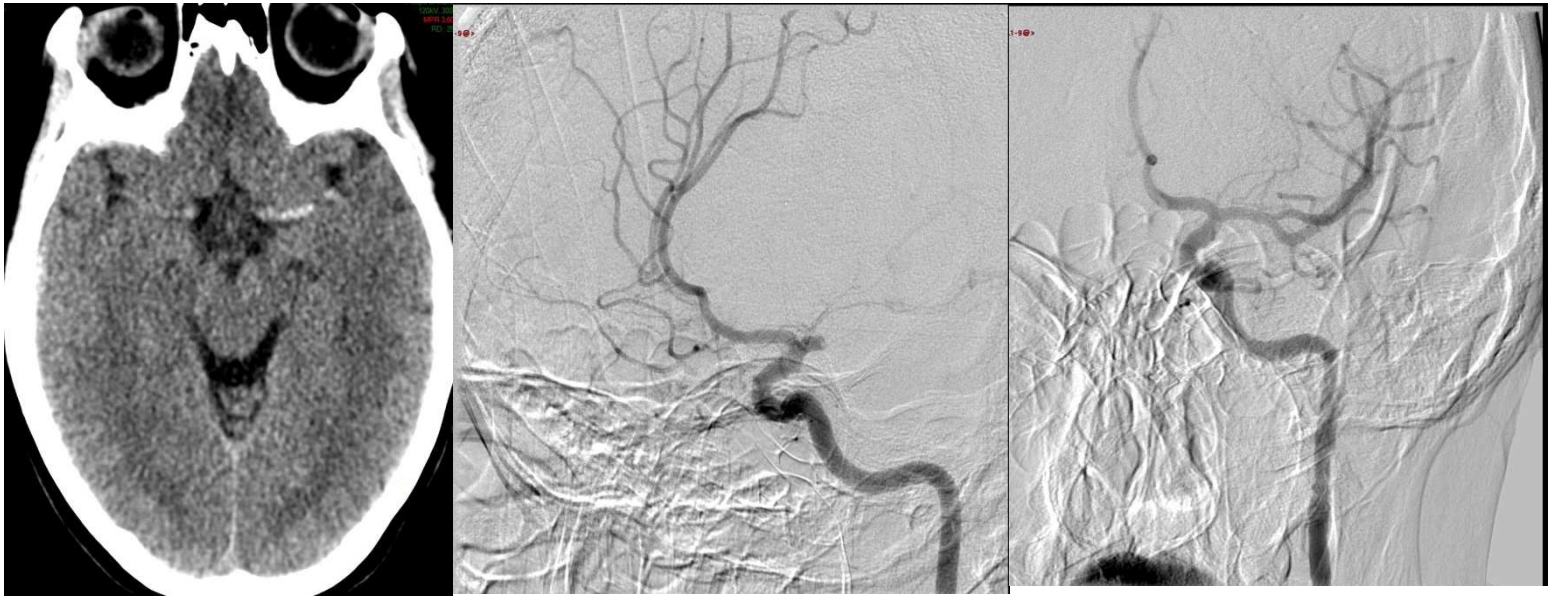
$I^2 = 75.9\%$, $P < .01$

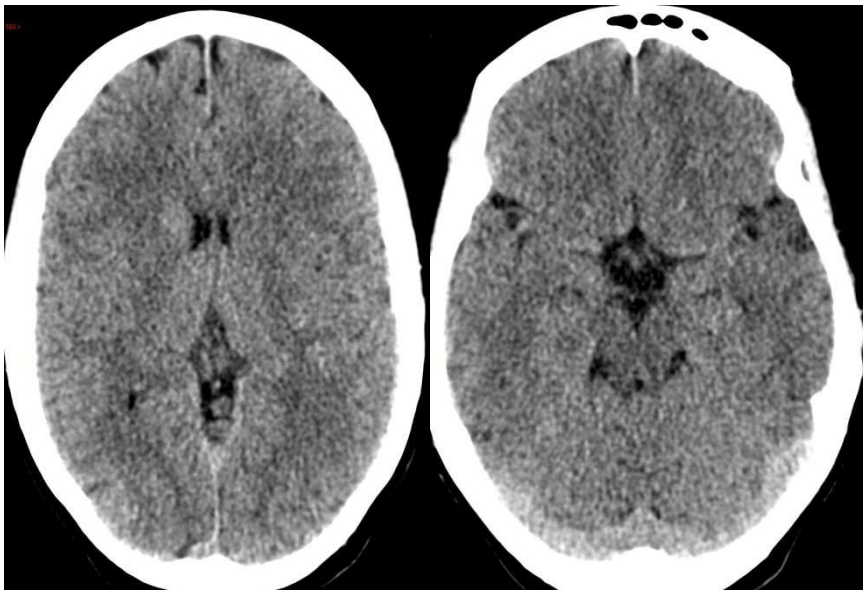


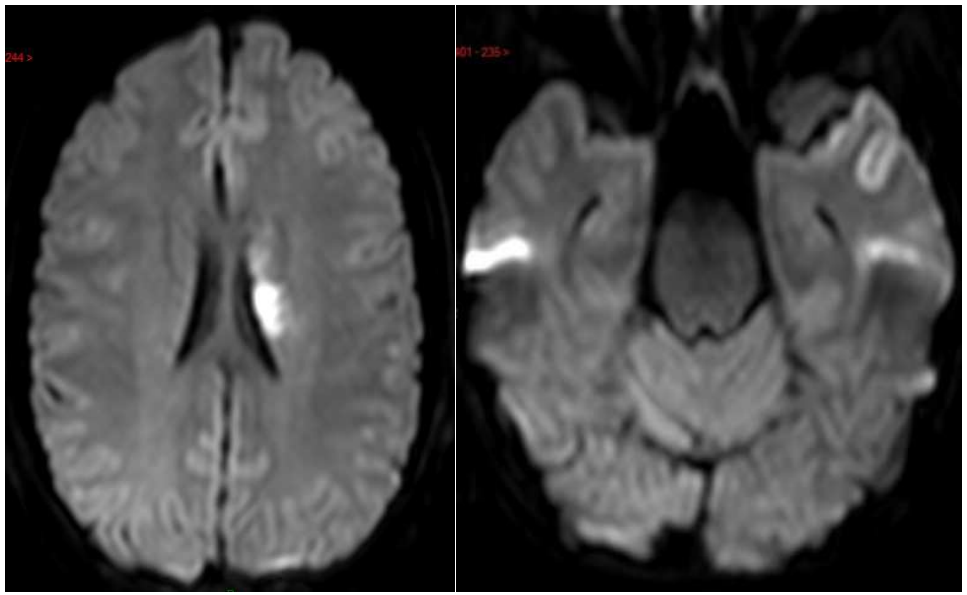
modified Rankin Scale (mRS)

- 0: asymptomatique
- 1: symptomes mineurs sans impact sur la QoL
- 2: léger handicap -> qques tâches avec assistance

- 3: handicap modéré -> marche sans assistance
- 4: handicap sévère -> incapable de marcher
- 5: handicap très sévère: grabataire
- 6: mort





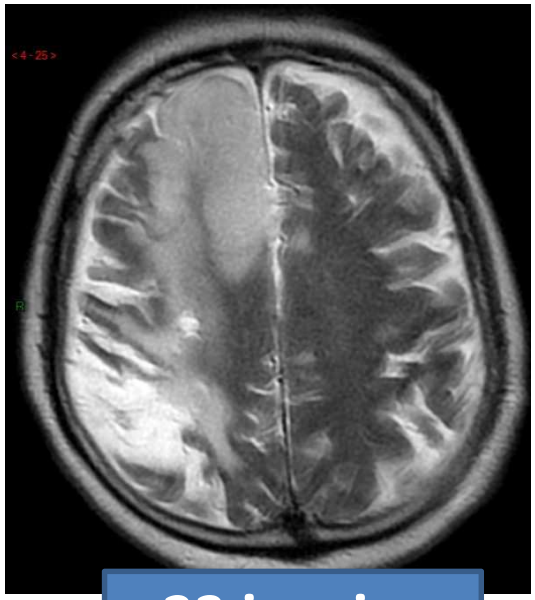


Contrôle CT à 24 heures

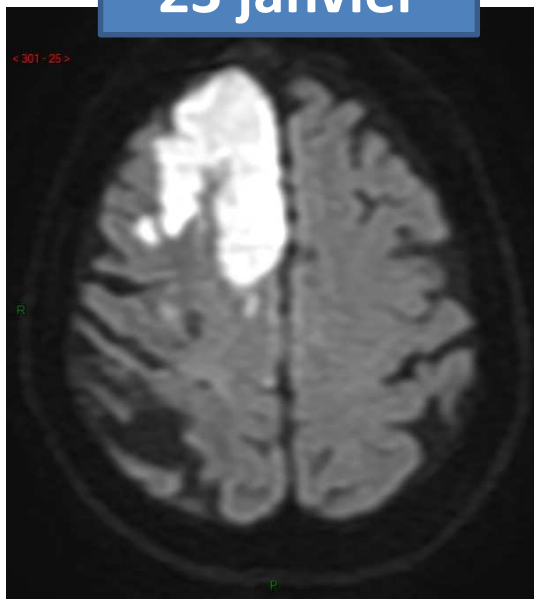
CT vs IRM ?

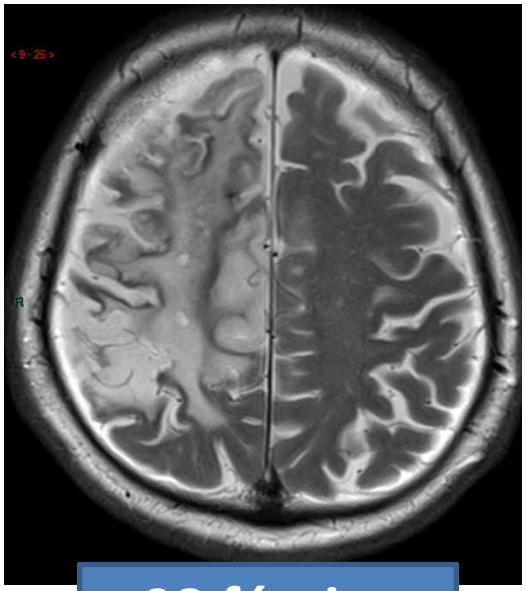
Contrôle IRM à 48 heures

Peut-on concevoir le management de l'AVC hyperaigu **sans** IRM ?

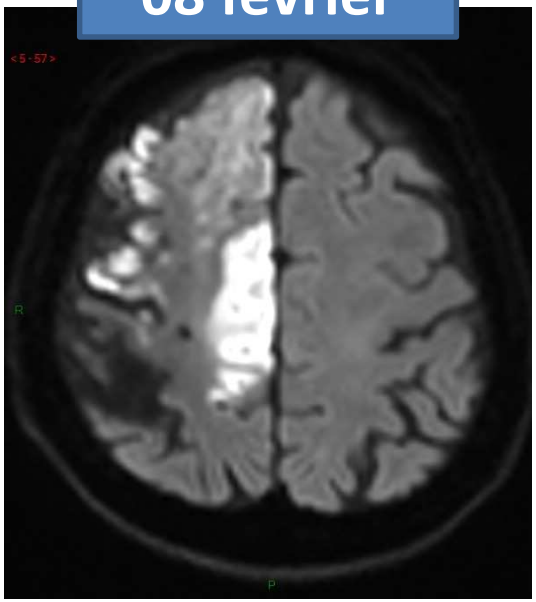


23 janvier



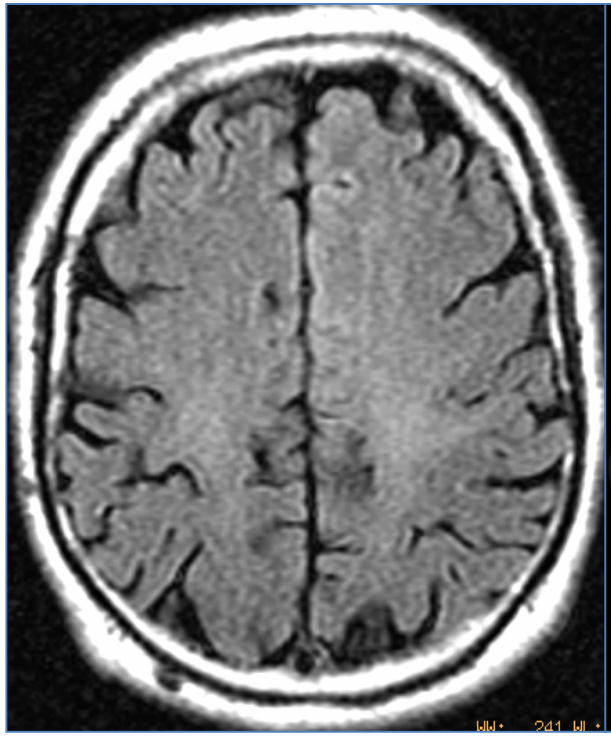


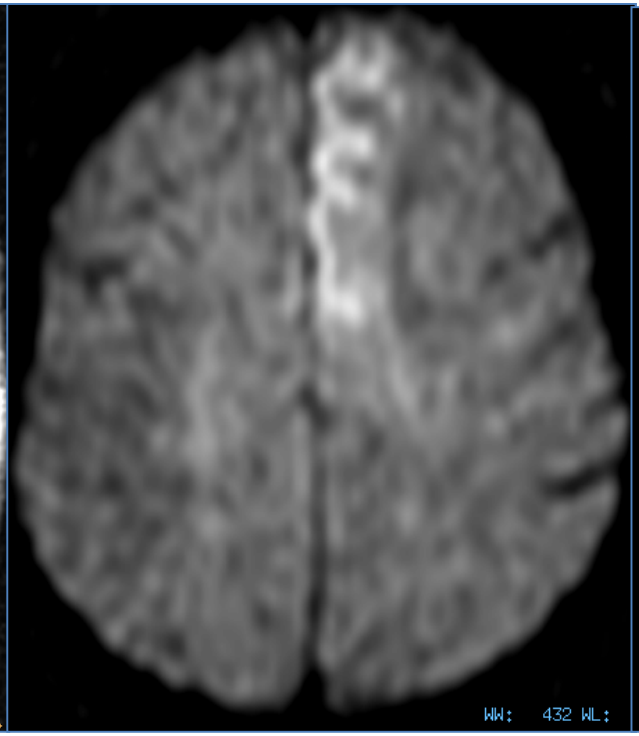
08 février

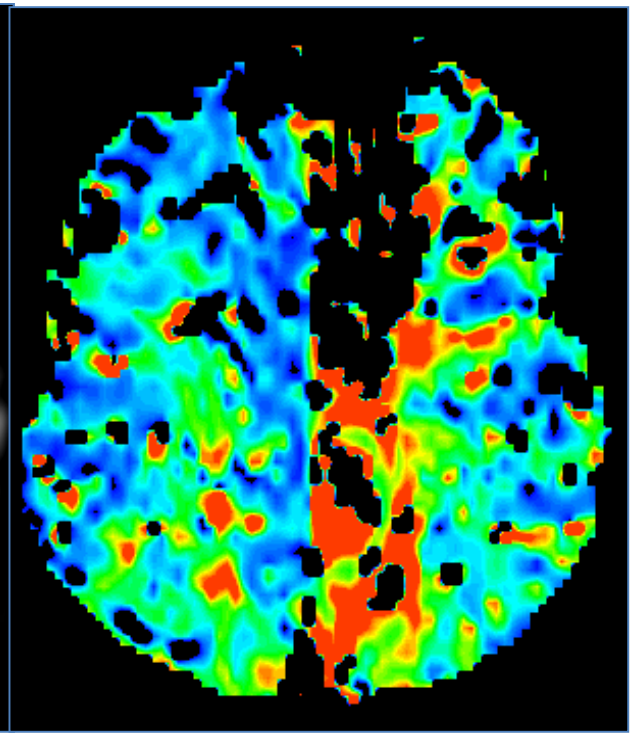


?

Peut-on concevoir le management de l'AVC hyperaigu **sans** IRM ?

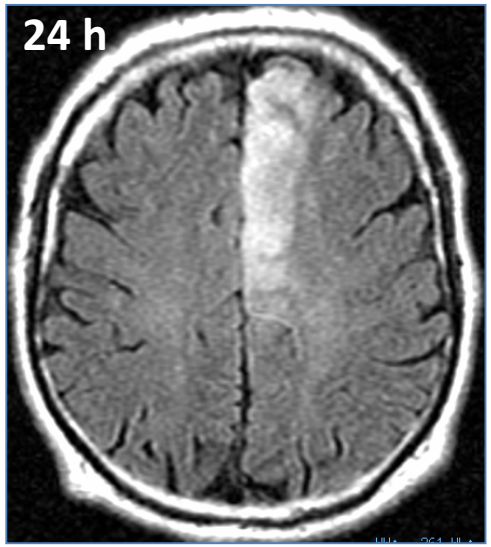




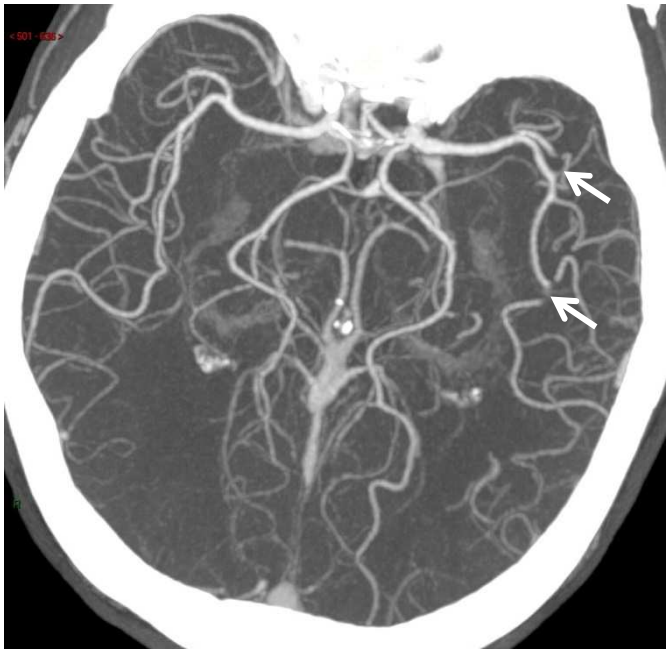


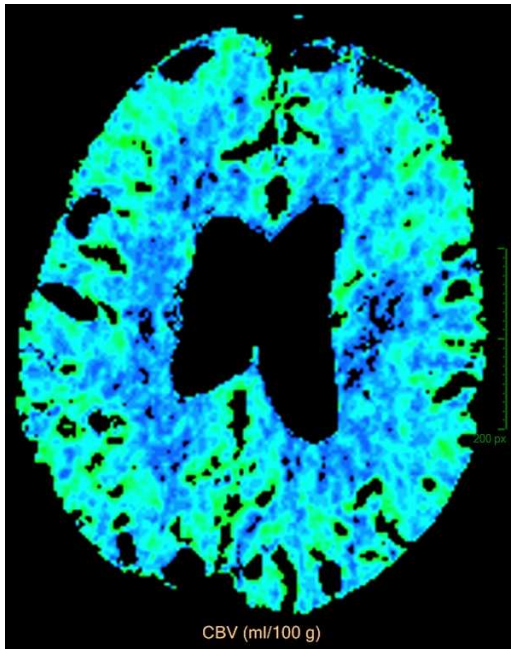
Mismatch DWI/PWI = pénombre

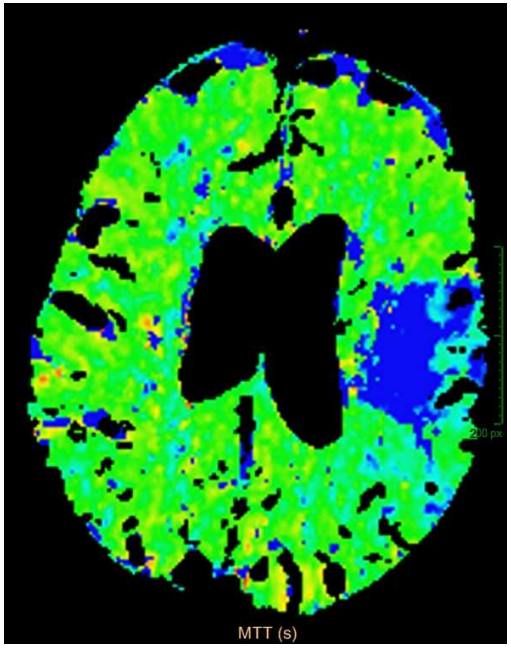
Thombolyse
Thrombectomie

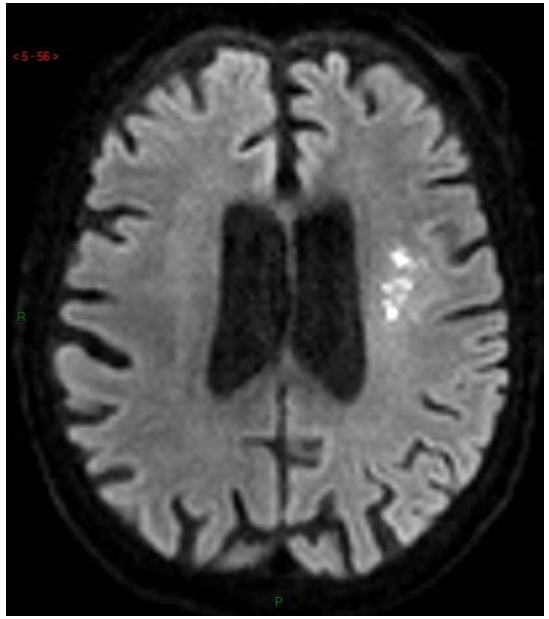


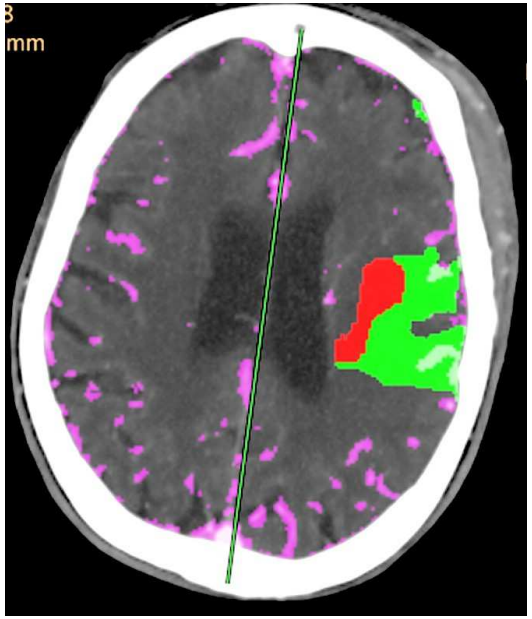
Peut-on concevoir le management de l'AVC hyperaigu **sans** IRM ?











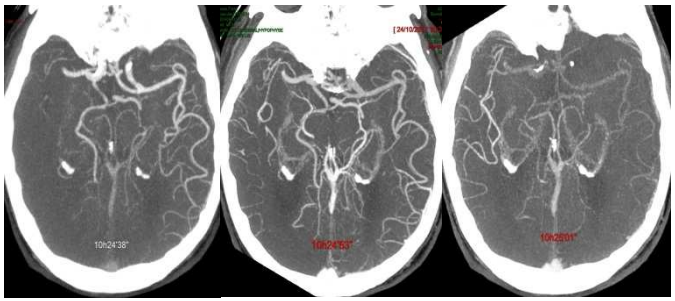
Guidelines UCL Stroke

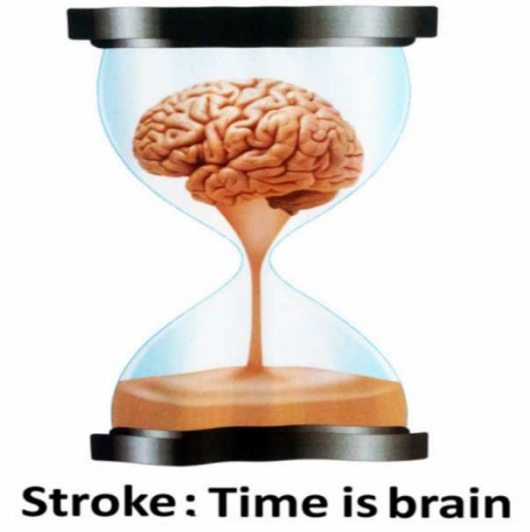
- CT en première intention
- Bon usage du trépied NCCT – CTA – **CTP**
- Pas de thombolyse > 4h30*
- Thombectomie > thrombolyse
  - **Critères de TRIAGE** nécessaire pour préciser bonnes indications de thrombectomie
  - **Dans l'immédiat usage immodéré du CTA triphasique**

* NINDS 1995 3h00
ECASS II 2007 4h30

Que va-t-il encore se passer en AVC aigu ?

- **better TRIAGE for thrombectomy**
- **mobile CTP**
- **full automated processing**





Ultimate challenge