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Angiopathie Amyloïde Cérébrale

Nouveaux critères diagnostiques radiologiques TDM et IRM (Boston v2.0 et Edimbourg)

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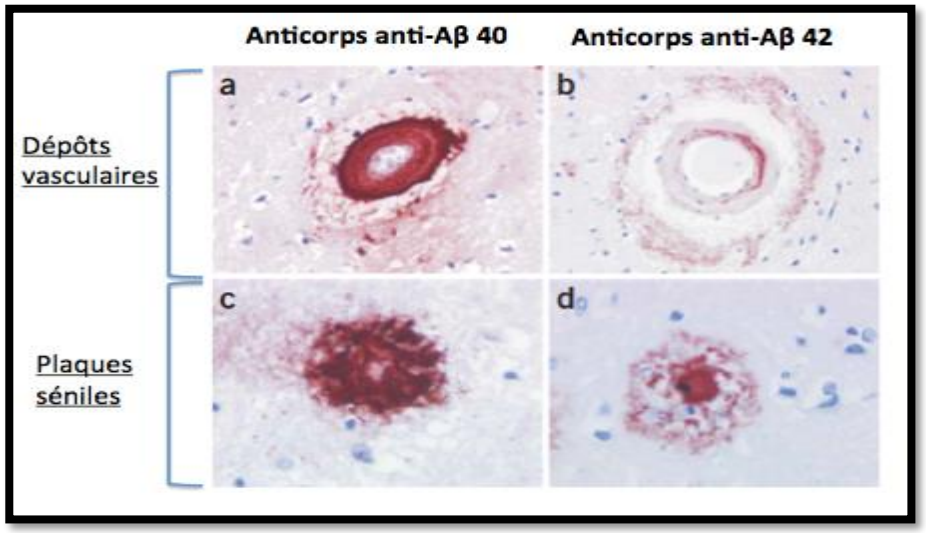
Neurologie CHU de Rouen

22 juin 2023

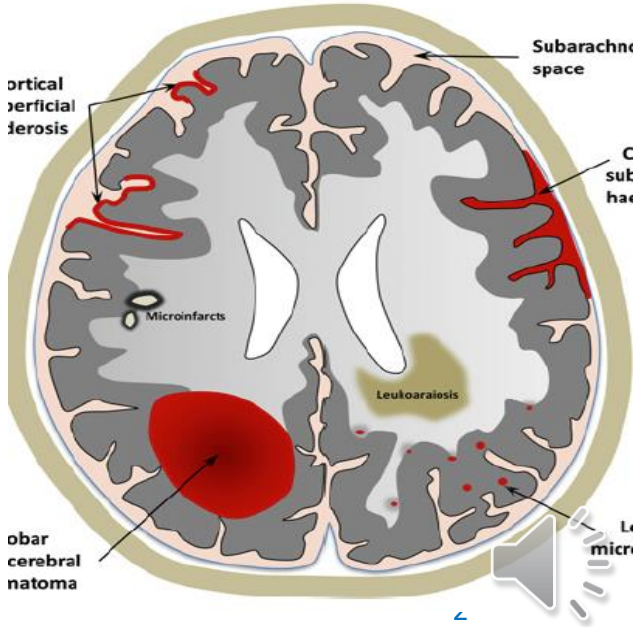
ANGIOPATHIE AMYLOIDE À Aβ



- Dépôts Aβ40 et Aβ42 (Aβ40 isoforme prédominant)
- Continuum avec la maladie d'Alzheimer (MA) (Aβ42 parenchymateux)

- 2 présentations principales:
  - Hématomes intracérébraux lobaires spontanés
  - Déclin cognitif progressif

- Mais aussi:
  - « TFNE » ou auras amyloïdes liée à de l'hémosidérose
  - Manifestations ischémiques (micro infarctus plutôt silencieux)
  - Formes inflammatoires AAC-ri



- Critères diagnostiques basés soit sur l'étude anatomopathologique soit sur l'imagerie par IRM
  - **Critères modifiés v2.0 de Boston, 2022**

Rovelet-Lecrux et al, Nature Genetics, 2006
Charidimou et al, Lancet, 2022
Greenberg et al., Nature, 2020

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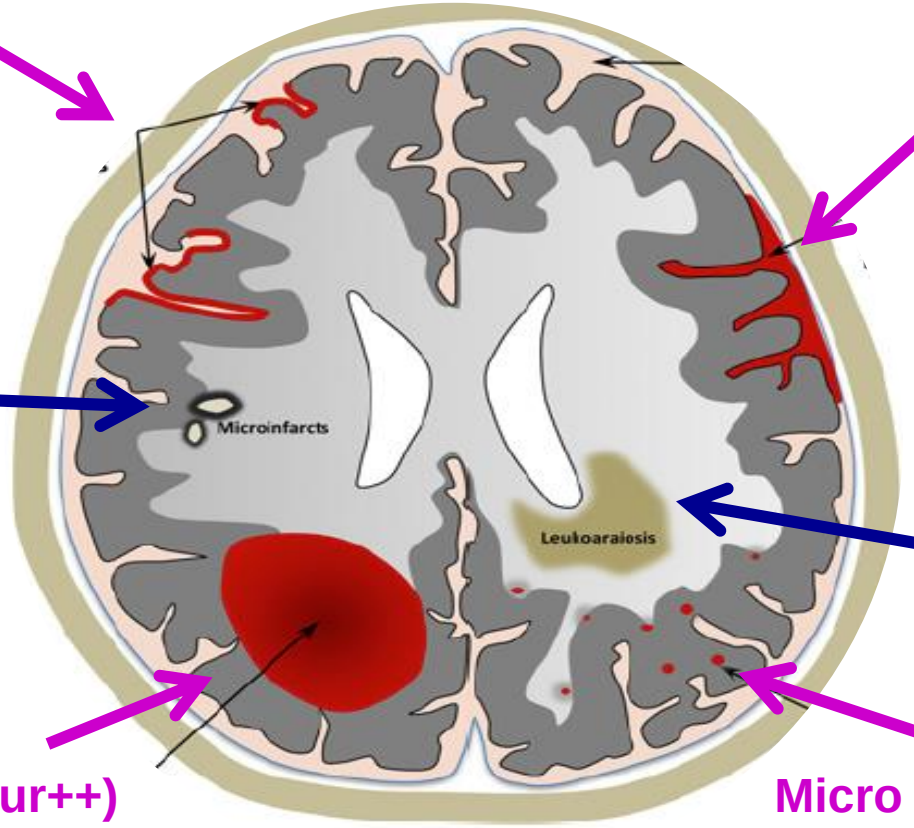
Hémosidérose corticale superficielle

Hémorragie sous-arachnoïdienne aigüe



Micro infarctus

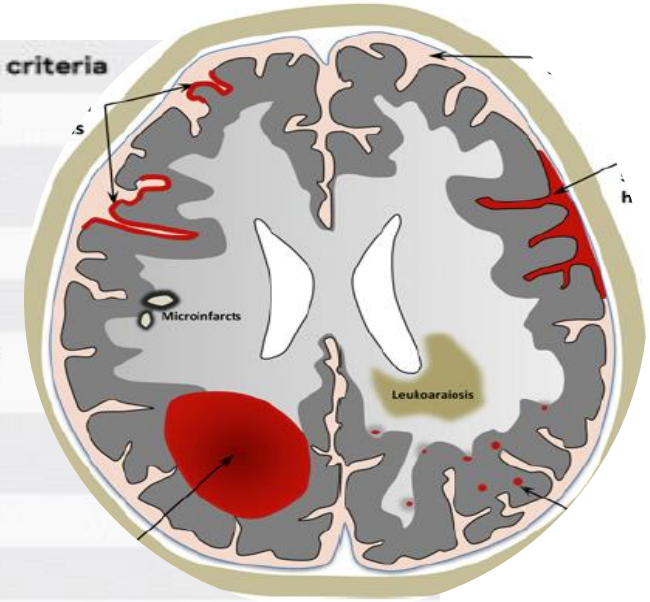
Leucopathie
- Prédominance postérieure
- Pattern « multi spot »

Hématome lobaire (postérieur++)

Micro saignements strictement lobaires

Anciennes versions des critères

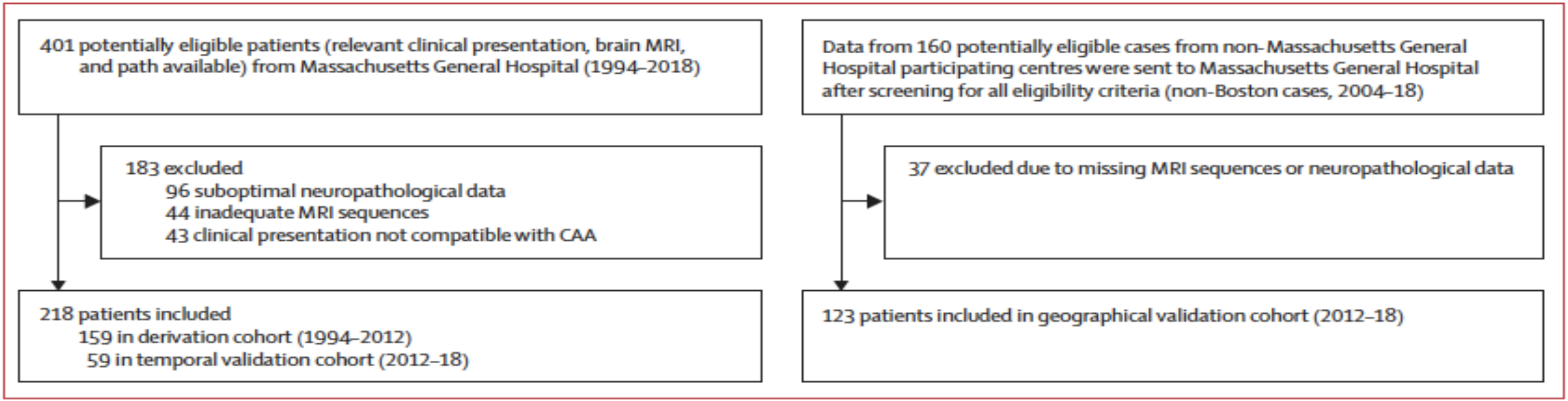
	Classic Boston criteria[2]	Modified Boston criteria
Definite CAA	Full postmortem examination demonstrating: • Lobar, cortical, or corticosubcortical hemorrhage • Severe CAA with vasculopathy • Absence of other diagnostic lesion	No modification[a]
Probable CAA with supporting pathology	Clinical data and pathologic tissue (evacuated hematoma or cortical biopsy) demonstrating: • Lobar, cortical, or corticosubcortical hemorrhage • Some degree of CAA in specimen • Absence of other diagnostic lesion	No modification[a]
Probable CAA	Clinical data and MRI or CT demonstrating: • Multiple hemorrhages restricted to lobar, cortical, or corticosubcortical regions (cerebellar hemorrhage allowed) • Age ≥55 y • Absence of other cause of hemorrhage	Clinical data and MRI or CT demonstrating: • Multiple hemorrhages restricted to lobar, cortical, or corticosubcortical regions (cerebellar hemorrhage allowed) or • Single lobar, cortical, or corticosubcortical hemorrhage and focal[b] or disseminated[c] superficial siderosis • Age ≥55 y • Absence of other cause of hemorrhage or superficial siderosis
Possible CAA	Clinical data and MRI or CT demonstrating: • Single lobar, cortical, or corticosubcortical hemorrhage • Age ≥55 y • Absence of other cause of hemorrhage	Clinical data and MRI or CT demonstrating: • Single lobar, cortical, or corticosubcortical hemorrhage or • Focal[b] or disseminated[c] superficial siderosis • Age ≥55 y • Absence of other cause of hemorrhage or superficial siderosis



The Boston criteria version 2.0 for cerebral amyloid angiopathy: a multicentre, retrospective, MRI–neuropathology diagnostic accuracy study

Andreas Charidimou, Gregoire Boulouis, Matthew P Frosch, Jean-Claude Baron, Marco Pasi, Jean Francois Albucher, Gargi Banerjee, Carmen Barbato, Fabrice Bonneville, Sebastian Brandner, Lionel Calviere, François Caparros, Barbara Casolla, Charlotte Cordonnier, Marie-Bernadette Delisle, Vincent Deramecourt, Martin Dichgans, Elif Gokcal, Jochen Herms, Mar Hernandez-Guillamon, Hans Rolf Jager, Zane Jaunmuktane, Jennifer Linn, Sergi Martinez-Ramirez, Elena Martínez-Sáez, Christian Mawrin, Joan Montaner, Solene Moulin, Jean-Marc Olivot, Fabrizio Piazza, Laurent Puy, Nicolas Raposo, Mark A Rodrigues, Sigrun Roeber, Jose Rafael Romero, Neshika Samarasekera, Julie A Schneider, Stefanie Schreiber, Frank Schreiber, Corentin Schwall, Colin Smith, Levente Szalardy, Pascale Varlet, Alain Viguier, Joanna M Wardlaw, Andrew Warren, Frank A Wollenweber, Marialuisa Zedde, Mark A van Buchem, M Edip Gurol, Anand Viswanathan, Rustam Al-Shahi Salman, Eric E Smith, David J Werring, Steven M Greenberg

Lancet Neurology, aout 2022


401 potentially eligible patients (relevant clinical presentation, brain MRI, and path available) from Massachusetts General Hospital (1994–2018)
183 excluded
96 suboptimal neuropathological data
44 inadequate MRI sequences
43 clinical presentation not compatible with CAA
218 patients included
159 in derivation cohort (1994–2012)
59 in temporal validation cohort (2012–18)
Data from 160 potentially eligible cases from non-Massachusetts General Hospital participating centres were sent to Massachusetts General Hospital after screening for all eligibility criteria (non-Boston cases, 2004–18)
37 excluded due to missing MRI sequences or neuropathological data
123 patients included in geographical validation cohort (2012–18)

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Panel: Boston criteria version 2.0 for sporadic cerebral amyloid angiopathy

1. Definite CAA

Full brain post-mortem examination demonstrating:

- Spontaneous intracerebral haemorrhage, transient focal neurological episodes, convexity subarachnoid haemorrhage, or cognitive impairment or dementia
- Severe CAA with vasculopathy
- Absence of other diagnostic lesion

2. Probable CAA with supporting pathology

Clinical data and pathological tissue (evacuated haematoma or cortical biopsy) demonstrating:

- Presentation with spontaneous intracerebral haemorrhage, transient focal neurological episodes, convexity subarachnoid haemorrhage, or cognitive impairment or dementia
- Some degree of CAA in specimen
- Absence of other diagnostic lesion

3. Probable CAA

For patients aged 50 years and older, clinical data and MRI demonstrating:

- Presentation with spontaneous intracerebral haemorrhage, transient focal neurological episodes, or cognitive impairment or dementia
- At least two of the following strictly lobar haemorrhagic lesions on T2*-weighted MRI, in any combination: intracerebral haemorrhage, cerebral microbleeds, or foci of cortical superficial siderosis or convexity subarachnoid haemorrhage

OR

- One lobar haemorrhagic lesion plus one white matter feature (severe perivascular spaces in the centrum semiovale or white matter hyperintensities in a multispot pattern)†
- Absence of any deep haemorrhagic lesions (ie, intracerebral haemorrhage or cerebral microbleeds) on T2*-weighted MRI
- Absence of other cause of haemorrhagic lesions‡
- Haemorrhagic lesion in cerebellum not counted as either lobar or deep haemorrhagic lesion

4. Possible CAA

For patients aged 50 years and older, clinical data and MRI demonstrating:

- Presentation with spontaneous intracerebral haemorrhage, transient focal neurological episodes, or cognitive impairment or dementia
- Absence of other cause of haemorrhage‡
- One strictly lobar haemorrhagic lesion on T2*-weighted MRI: intracerebral haemorrhage, cerebral microbleeds, or foci of cortical superficial siderosis or convexity subarachnoid haemorrhage

OR

- One white matter feature (severe visible perivascular spaces in the centrum semiovale or white matter hyperintensities in a multispot pattern)†
- Absence of any deep haemorrhagic lesions (ie, intracerebral haemorrhage or cerebral microbleeds) on T2*-weighted MRI
- Absence of other cause of haemorrhagic lesions‡
- Haemorrhagic lesion in cerebellum not counted as either lobar or deep haemorrhagic lesion

CAA=cerebral amyloid angiopathy. †Notable changes from the Boston criteria v1.5. ‡Other causes of haemorrhagic lesion: antecedent head trauma, haemorrhagic transformation of an ischaemic stroke, arteriovenous malformation, haemorrhagic tumour, CNS vasculitis. Other causes of cortical superficial siderosis and acute convexity subarachnoid haemorrhage should also be excluded.

Age > 50 ans

Probable si hémosidérose disséminée

Intégration marqueurs non hémorragiques

Hématome cervelet non comptabilisé

Exclusion si saignement profond

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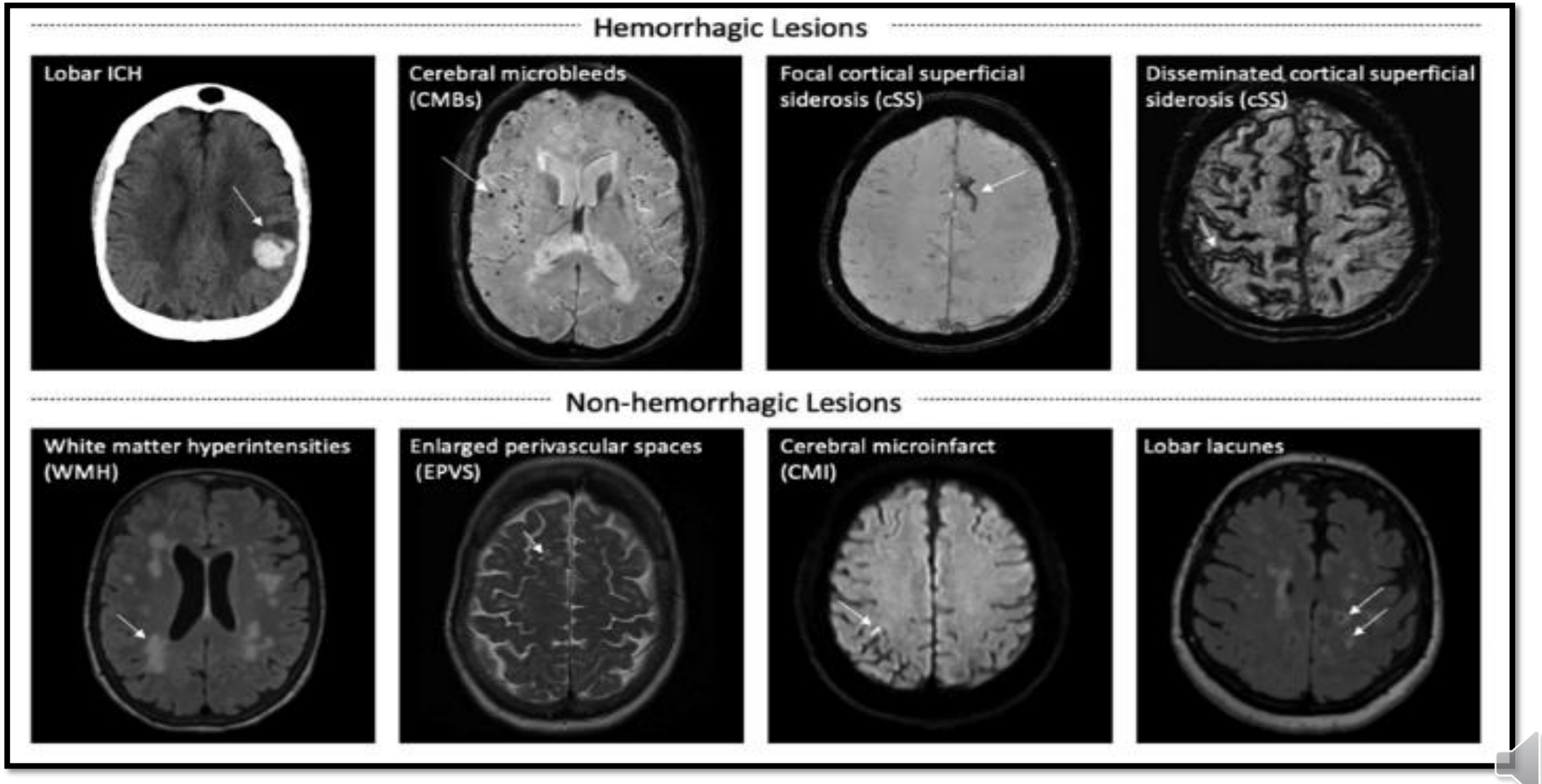
Développement de nouveaux marqueurs radiologiques



Développement de nouveaux marqueurs radiologiques

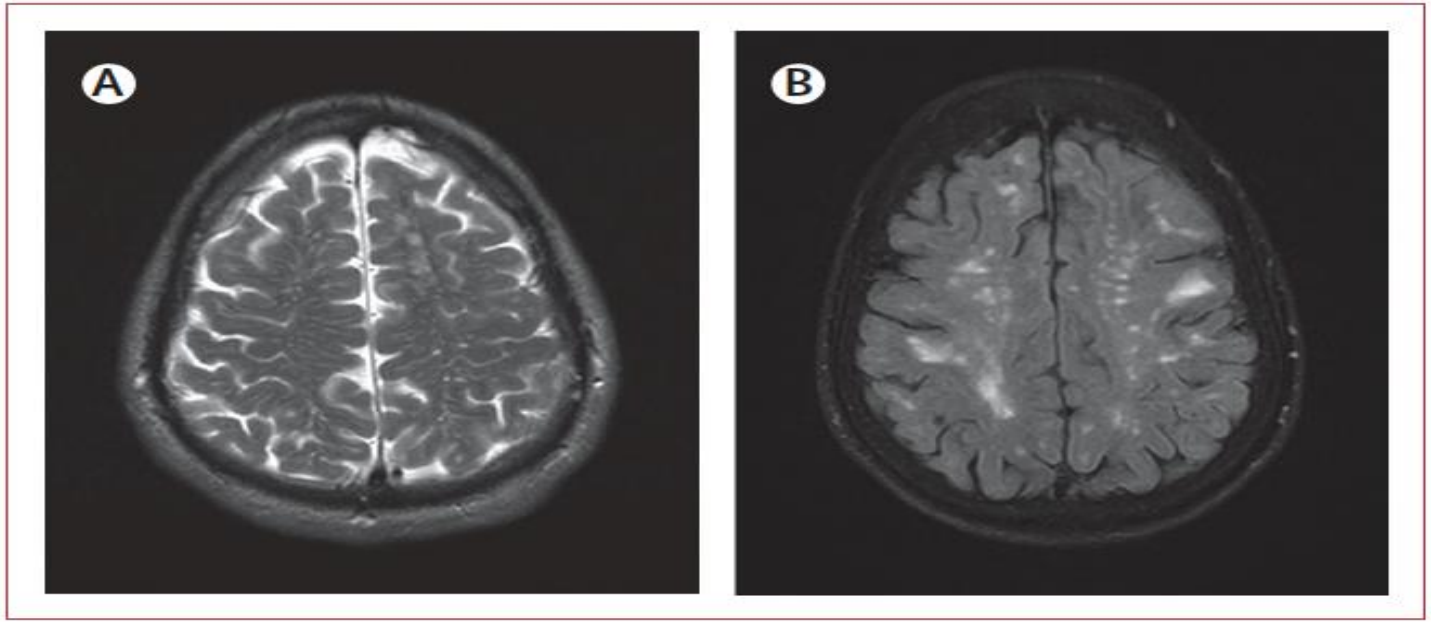


Figure 1: **Non-haemorrhagic white matter MRI markers assessed and finally included in the Boston criteria v2.0**
(A) Severe centrum semiovale perivascular spaces, identified on axial T2-weighted images,[17] are defined as more than 20 visible perivascular spaces in the centrum semiovale of one hemisphere.[6] (B) The multispot white matter hyperintensity pattern is defined as more than ten T2-weighted fluid-attenuated inversion recovery small circular or ovoid hyperintense lesions in the subcortical white matter of both hemispheres.[8]

Diagnostic différentiel chez le sujet âgé: HTA ++

	AAC	Microangiopathie hypertensive
Hématomes cérébraux	Lobaire	Profond (Noyaux gris centraux, tronc cérébral)
Infarctus cérébral	Rare	Lacunes
Microsaignements	Exclusivement lobaire	Profonds principalement
Sidérose corticale superficielle	40% des cas	Rare
Espaces péri-vasculaires dilatés	Centres semi-ovales	Noyaux gros centraux
Leucopathie vasculaire	Prédominance postérieure	Toutes localisation, atteinte du tronc cérébral
Atrophie cérébrale		

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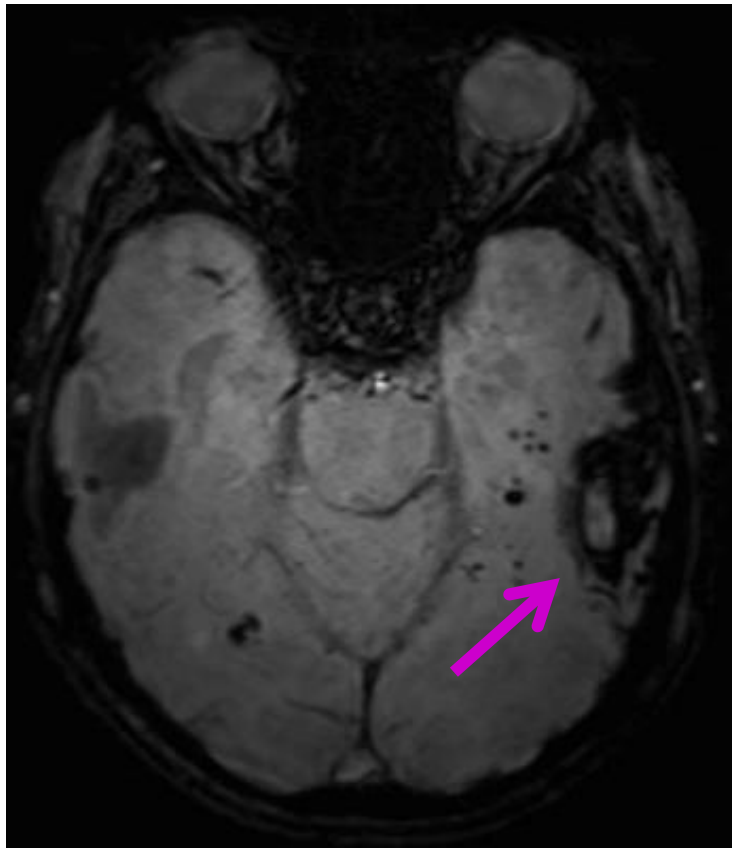
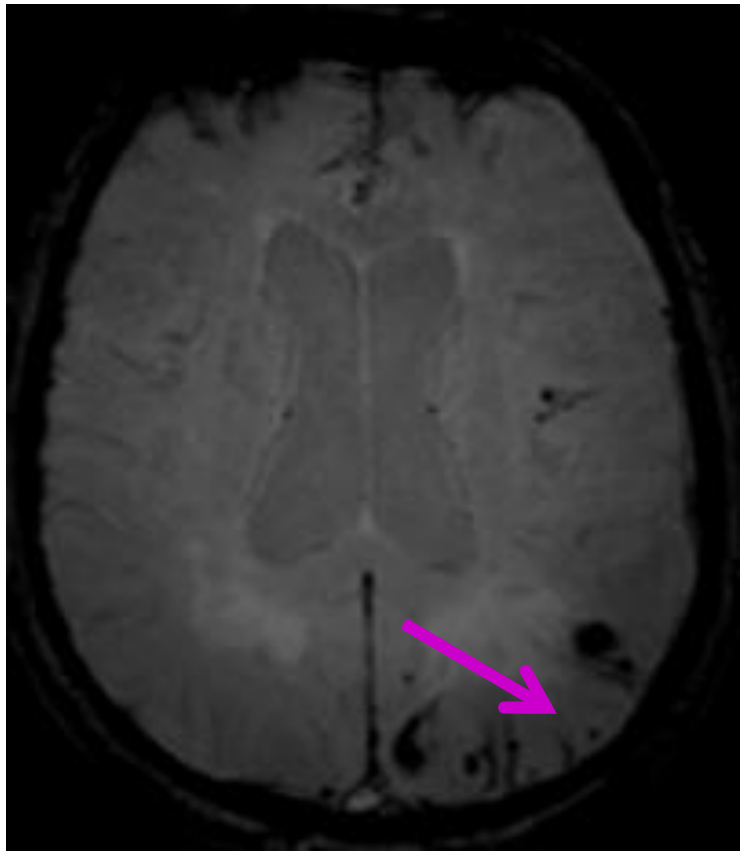
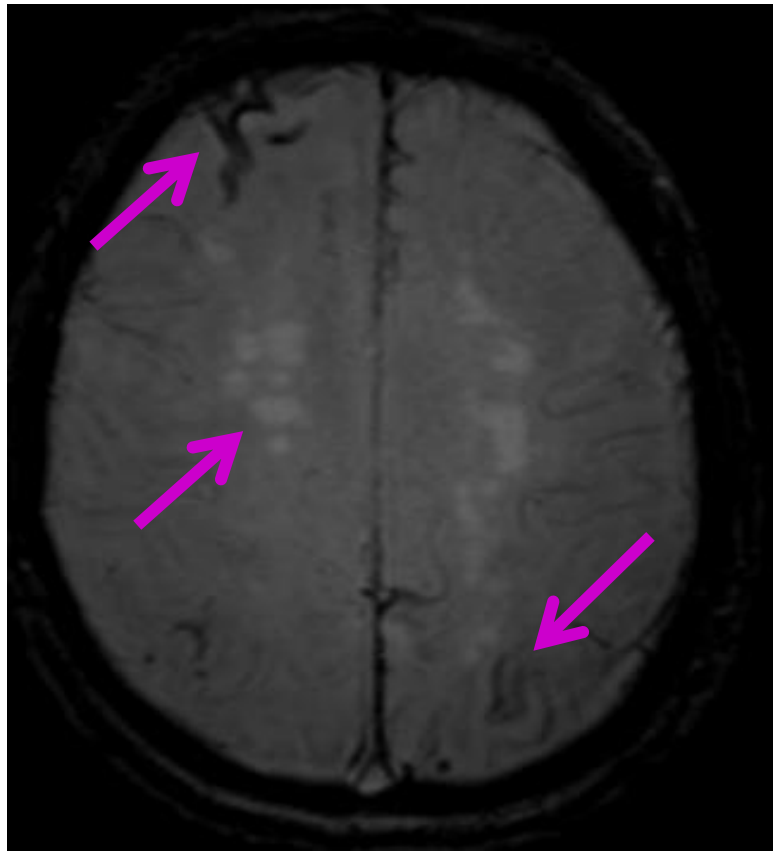
En images: Homme 74 ans







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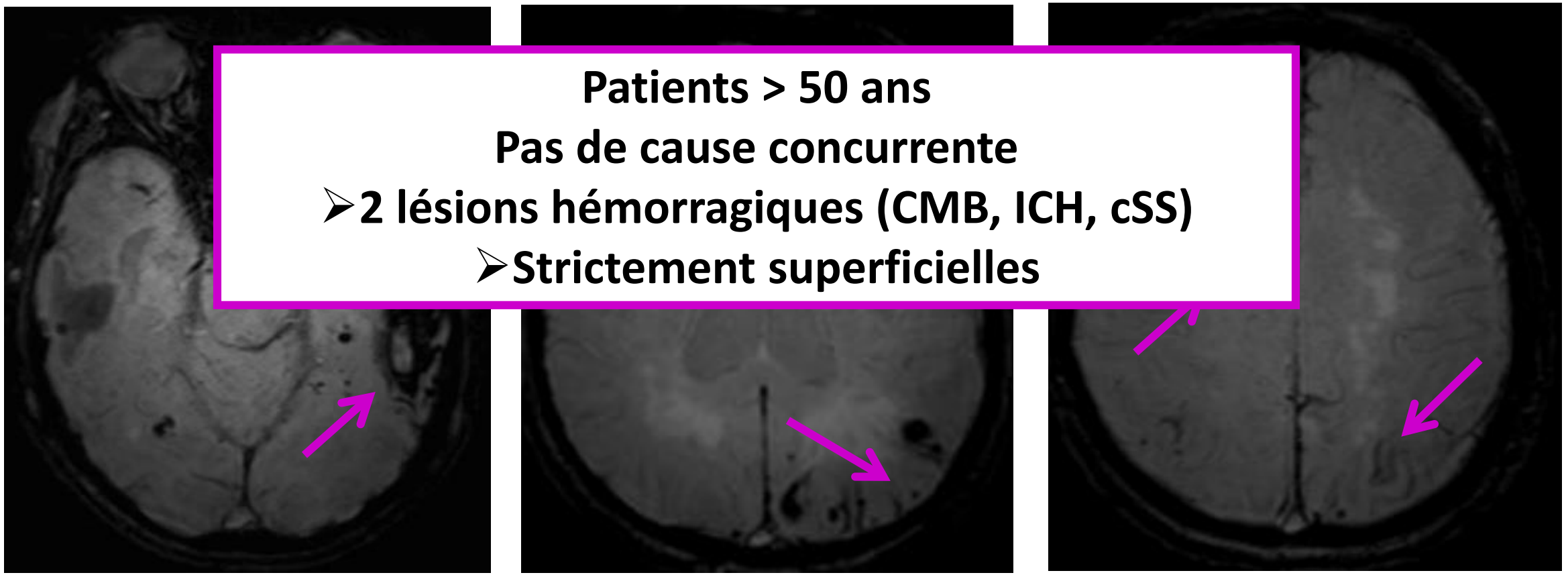
En images: Homme 74 ans



Patients > 50 ans

Pas de cause concurrente

- **2 lésions hémorragiques (CMB, ICH, cSS)**
- **Strictement superficielles**

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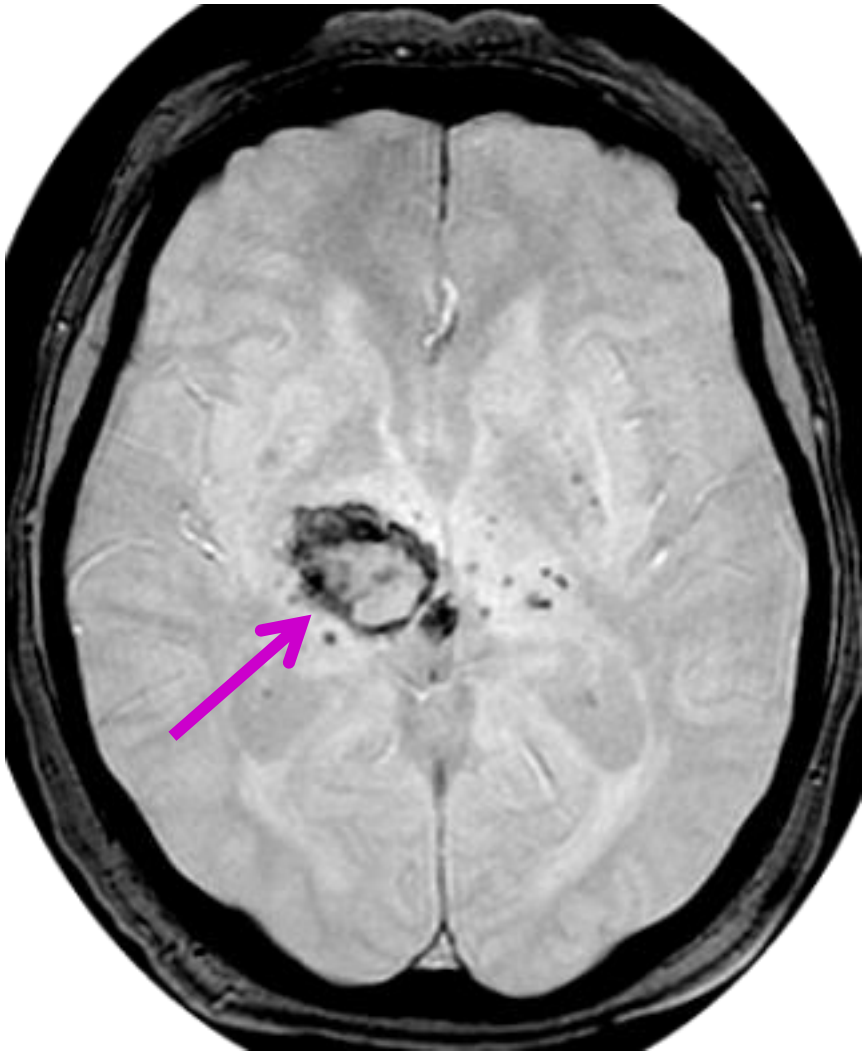
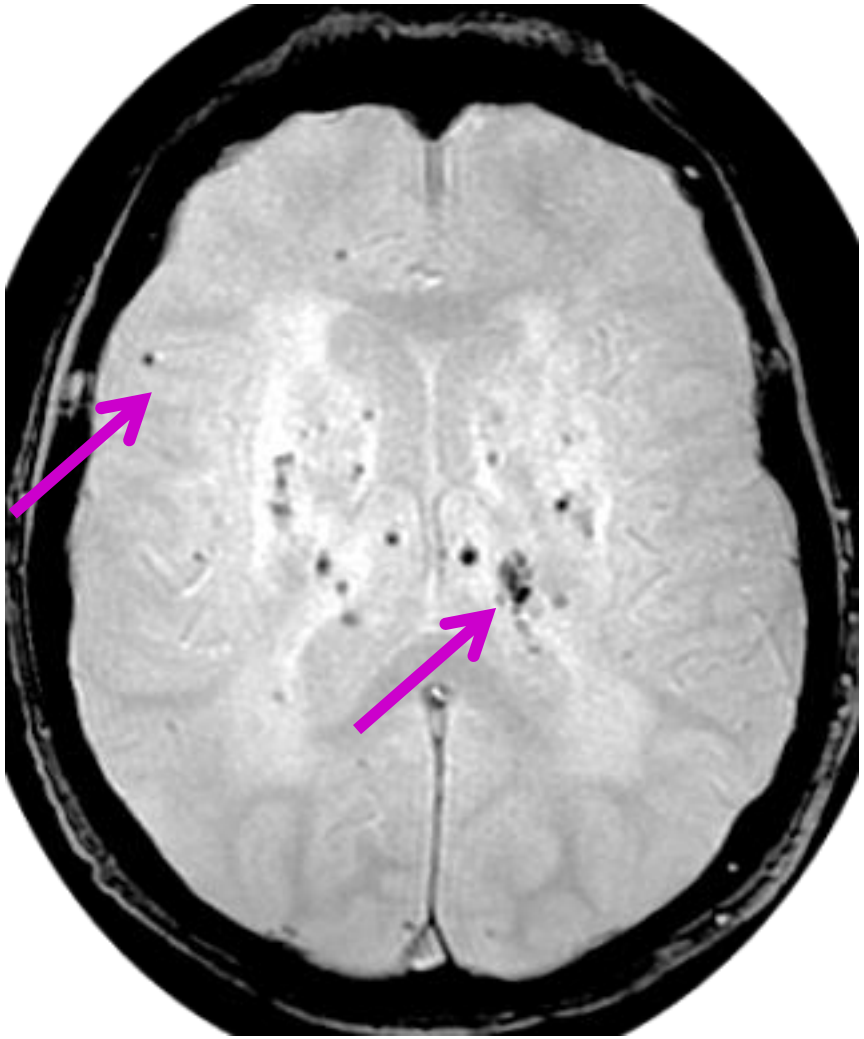
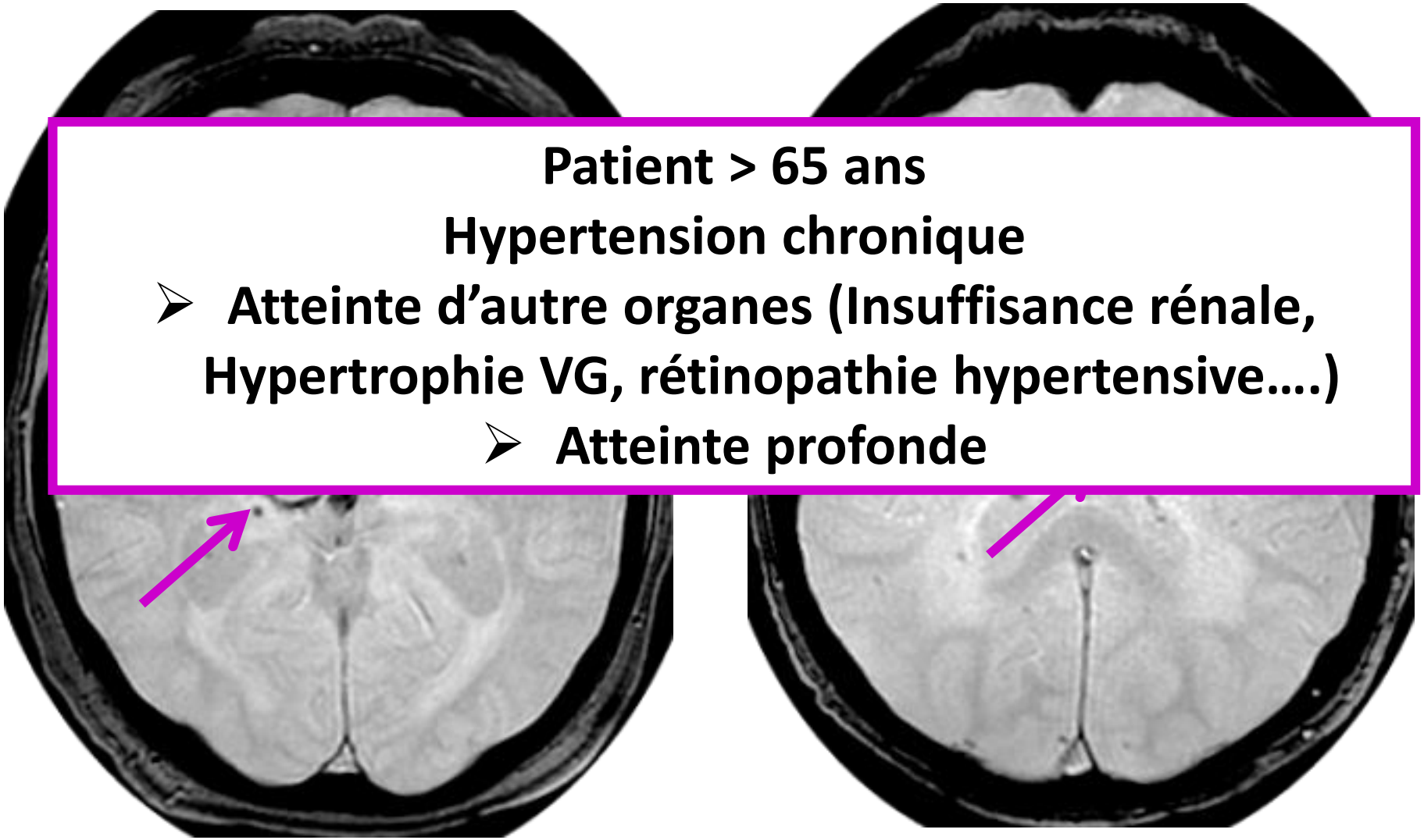
En images: Femme 78 ans





En images: Femme 78 ans



Patient > 65 ans

Hypertension chronique

- **Atteinte d'autre organes (Insuffisance rénale, Hypertrophie VG, rétinopathie hypertensive….)**
- **Atteinte profonde**

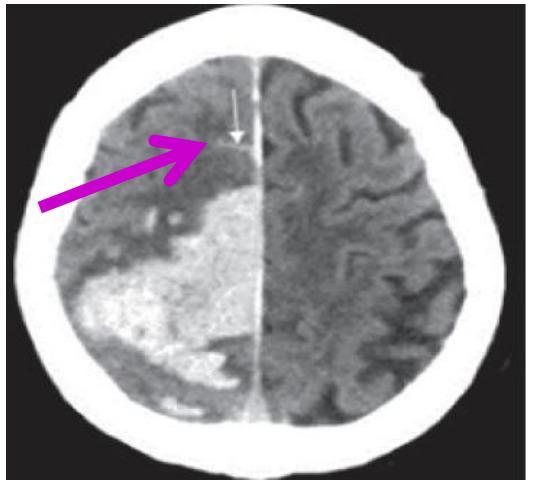
CRITÈRES D'EDIMBOURG TDM SANS INJECTION

- Intéressant dans un contexte d'urgence / Accès limité à l'IRM / Contre-indication IRM
  - Impact sur décisions chirurgicales
  - Orientation du patient

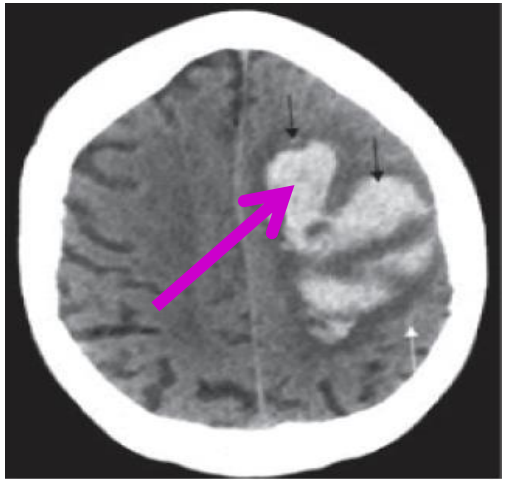
- 3 marqueurs:
  - **Extension en doigt de gant**
  - **HSA associée à l'hématome**
  - **Génotype APOE4** (???)

- Très bonne valeur prédictive positive :
  - Si présents = Diagnostic AAC fort probable
  - Moins bonne valeur prédictive négative

HSA associée



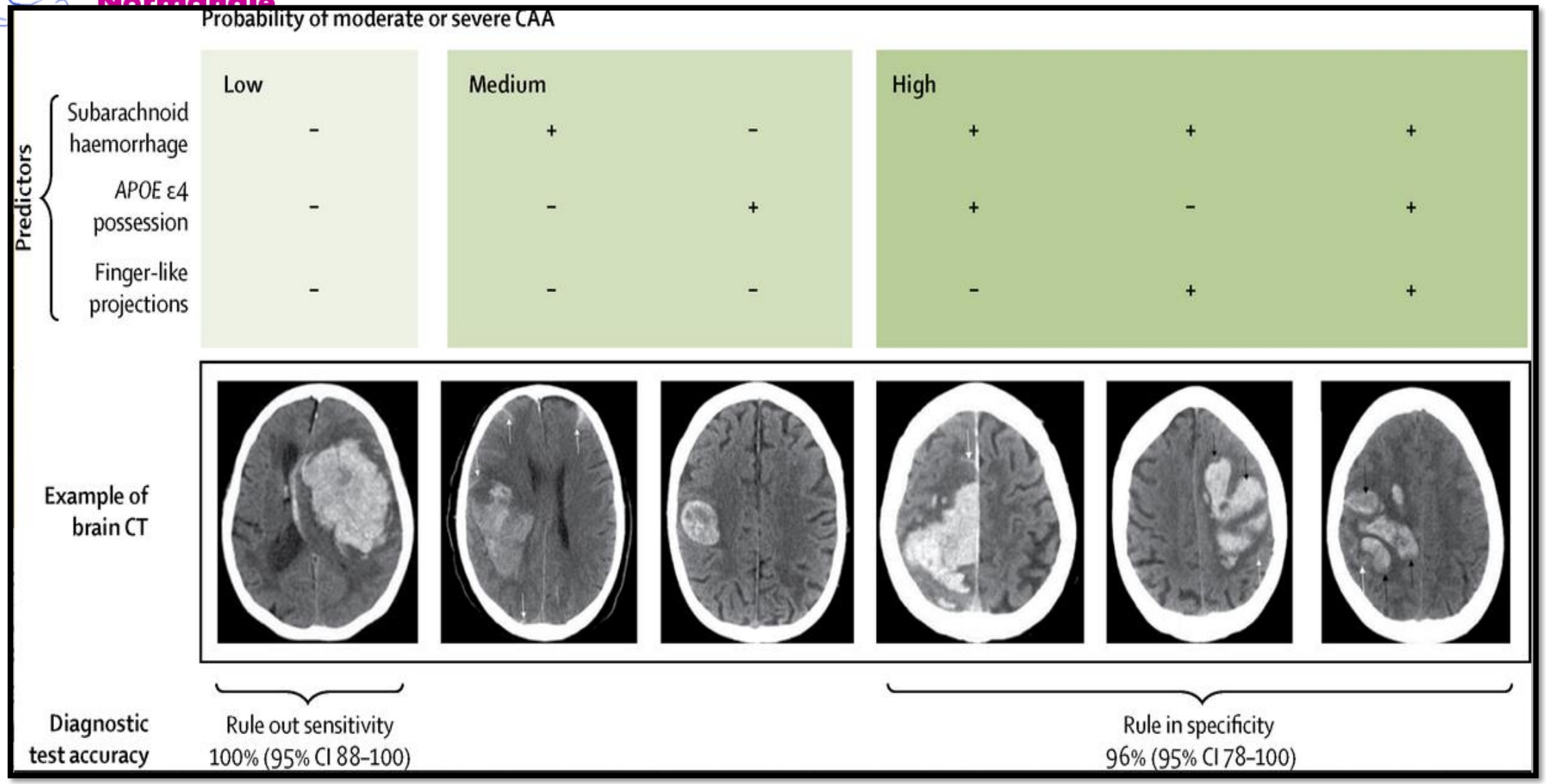
Extension en doigt de gant



Rodrigues et al, Lancet Neurol, 2018

Ne permet pas de se passer d'une injection!!!
Toujours recherche cause concurrente

Critères d'Edimbourg sur TDM sans injection



Rodrigues et al, Lancet Neurol, 2018

CRITÈRES D'EDIMBOURG TDM SANS INJECTION

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Validation externe

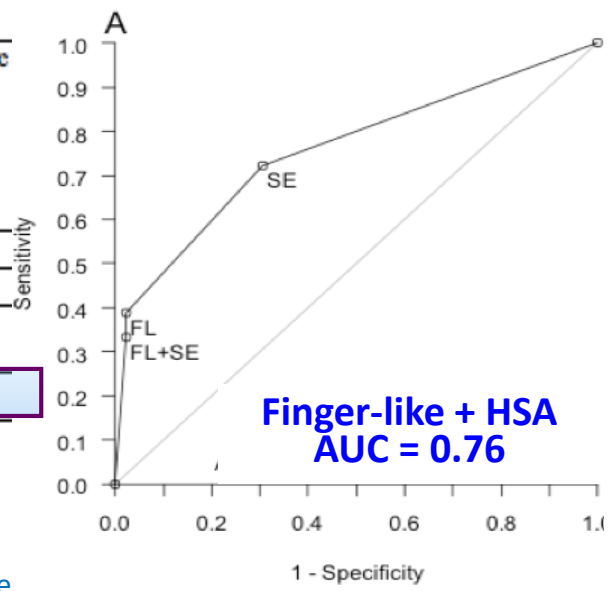
- en utilisant l'IRM comme gold standard
- en excluant le génotype APOE

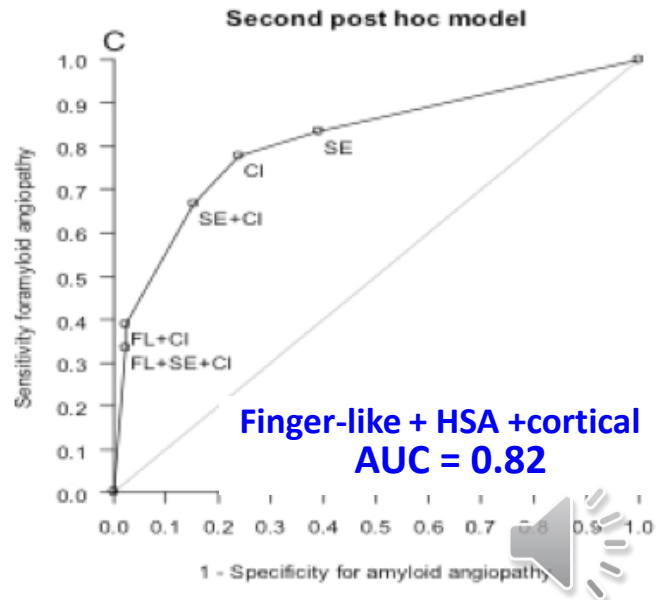
102 patients se présentant en urgence pour HIP lobaire spontané

- Classés en AAC / Non AAC / Indéterminés
- Double lecture radiologique

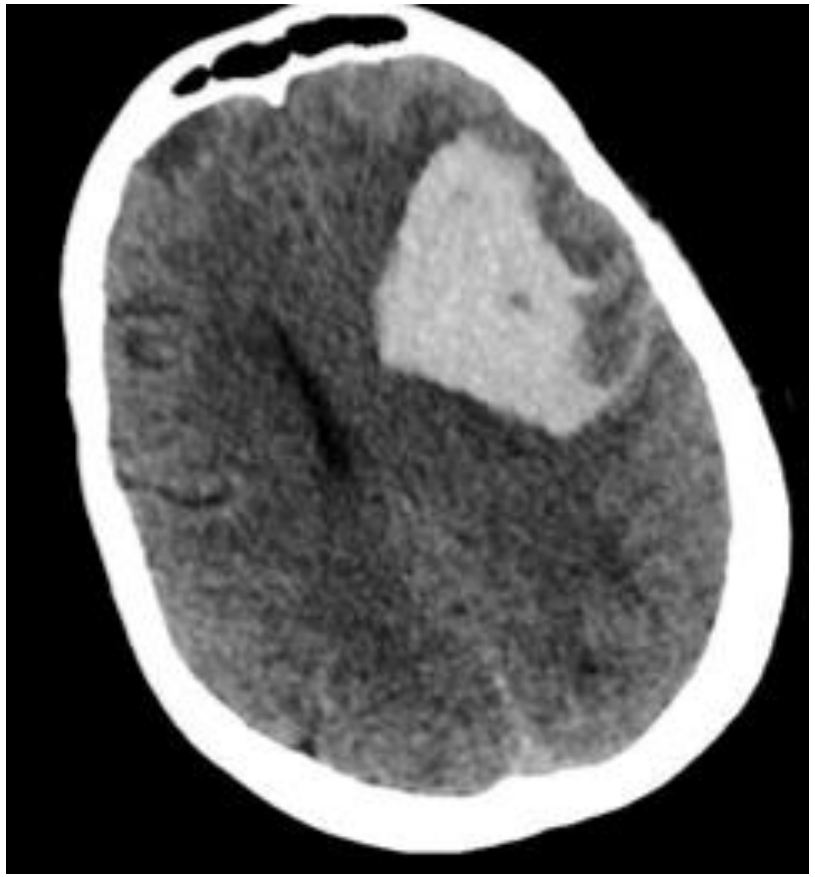
Predicted probability threshold (Edinburgh criteria fullfilled)	Sensitivity % [CI95%]	Specificity % [CI95%]	Positive predictive value % [CI95%]	Negative predictive value % [CI95%]
≥ 22% (None)	100%	0%	44% [33-55%]	N/A
≥ 62% (SE)	72% [55-86%]	70% [54-82%]	65% [48-79%]	24% [12-39%]
≥ 84% (FL)	39% [23-57%]	98% [88-100%]	93% [68-100%]	33% [22-45%]
= 97% (FL+SE)	33% [19-51%]	98% [88-100%]	92% [64-100%]	35% [24-47%]

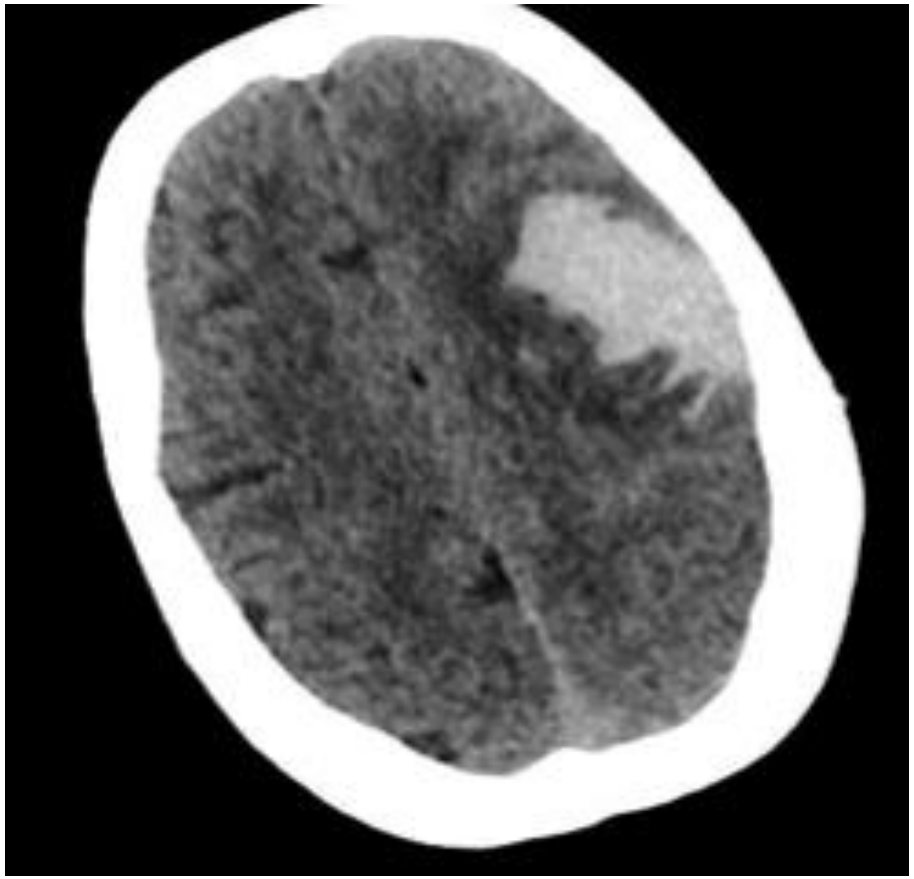
Grangeon et al, J. Neuroradiology. 2022





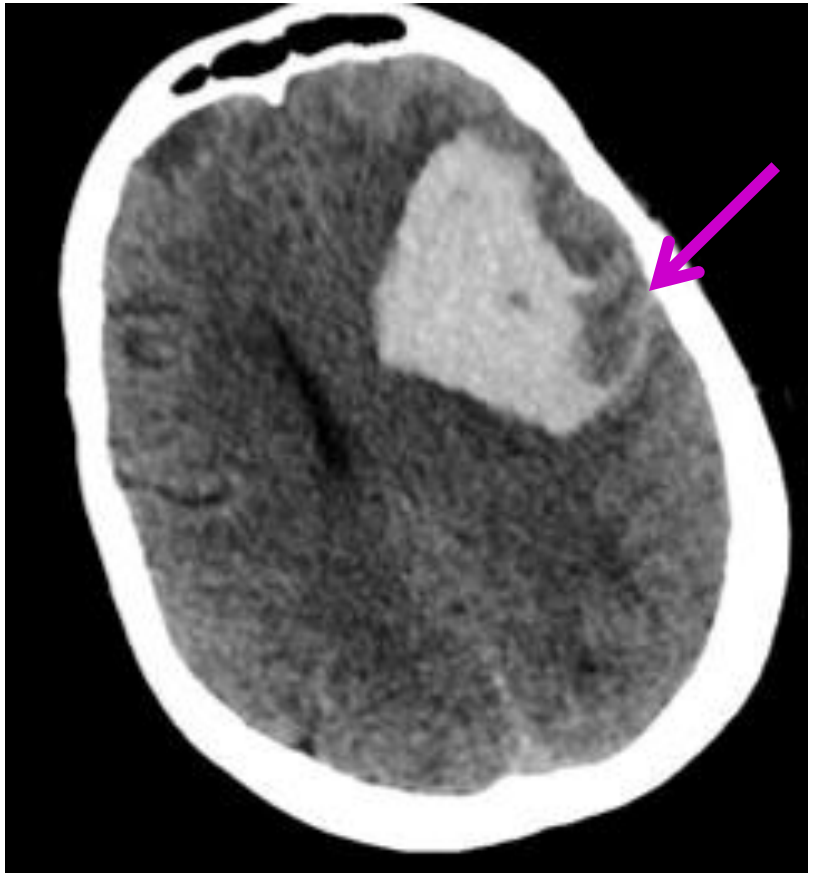
En images « rouennaises »: Femme 70 ans

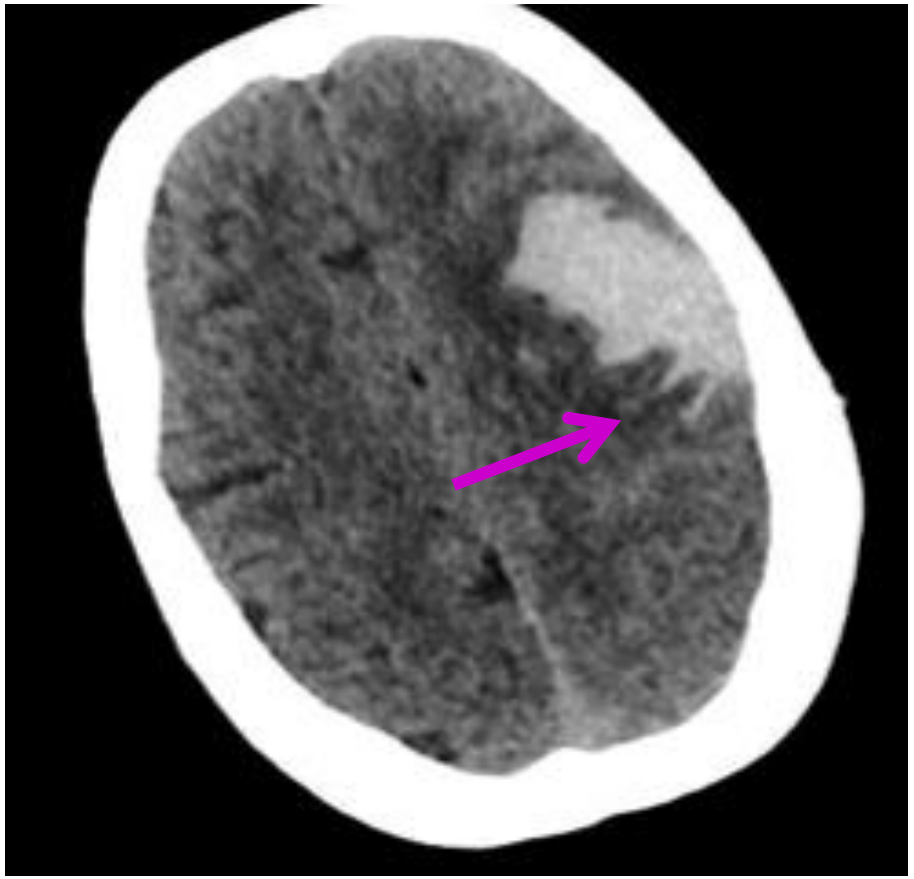




Critères remplis?

En images « rouennaises »: Femme 70 ans





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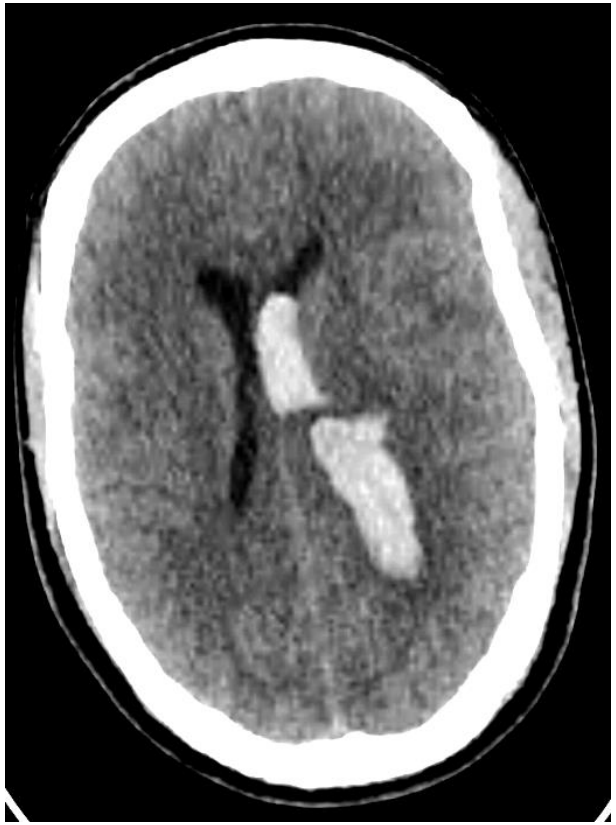

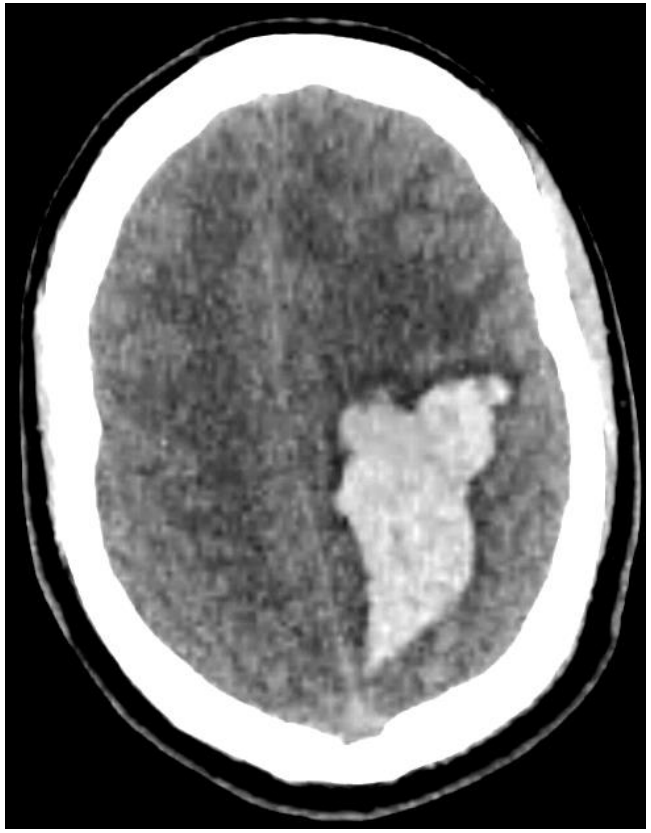

Critères remplis?

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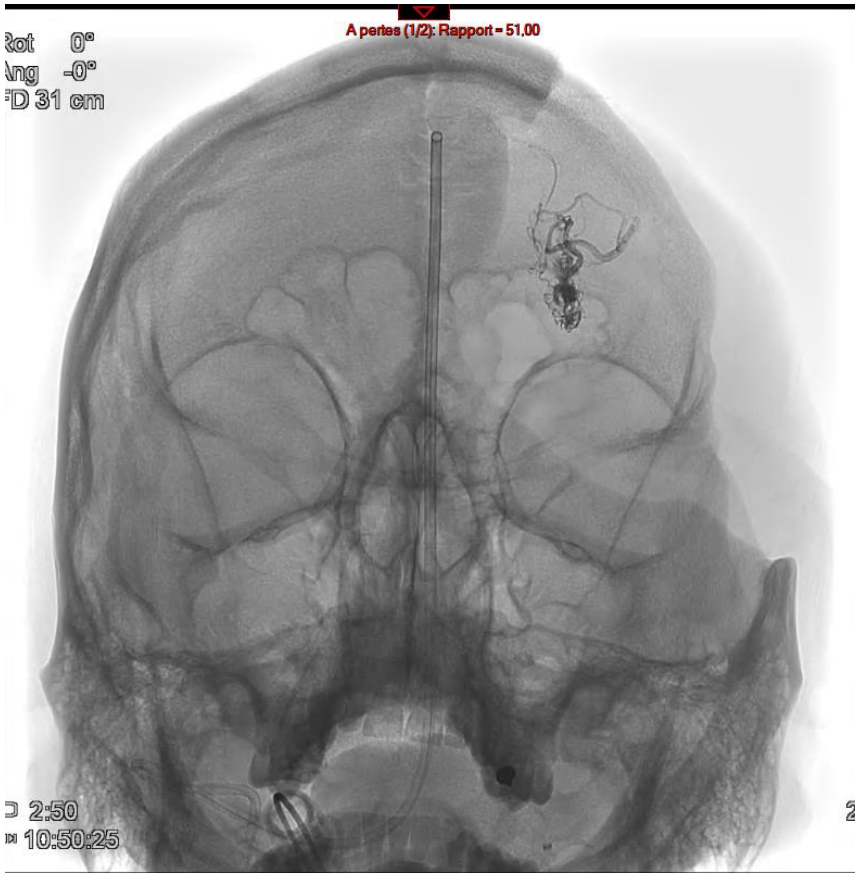
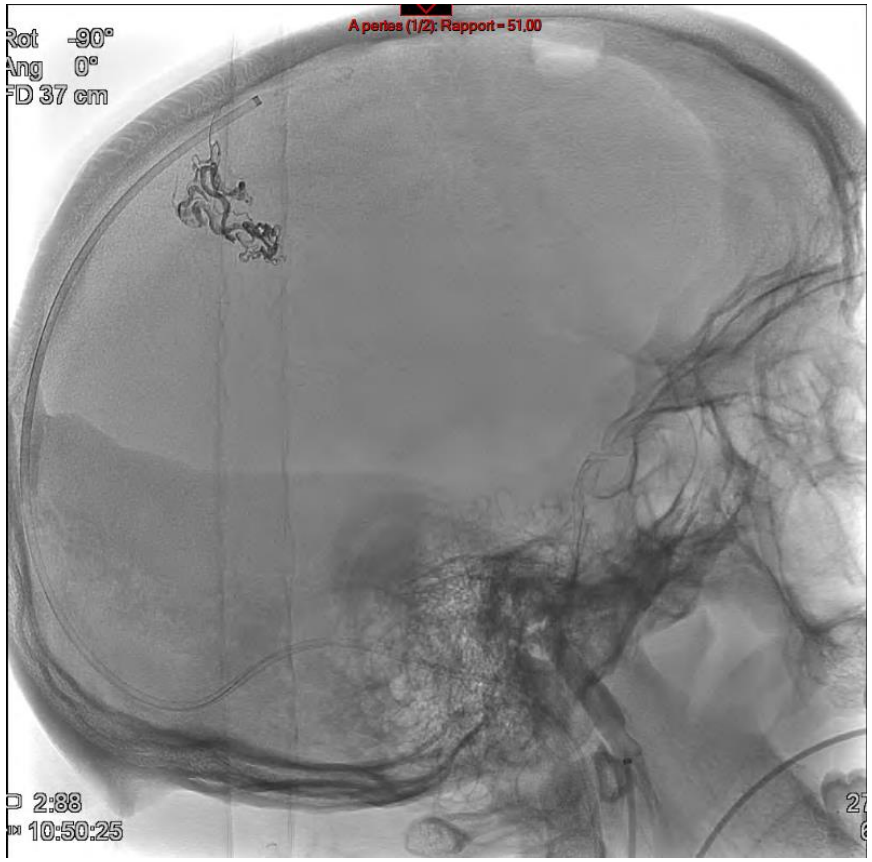
Je ne suis pas NRI mais….





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Merci de votre attention