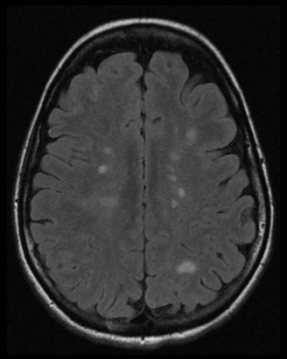
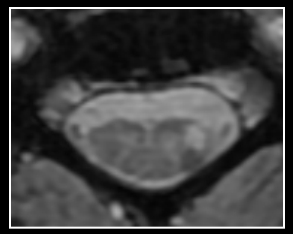
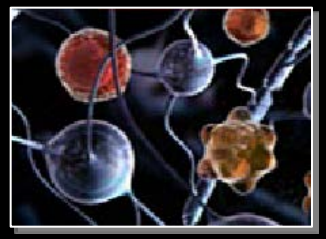
SFNR
SOCIÉTÉ FRANÇAISE DE NEURORADIOLOGIE
42ème CONGRÈS ANNUEL
de la Société Française
de NeuroRadiologie
8-10 avril 2015
Novotel Paris Tour Eiffel

Actualités IRM dans la SEP

Thomas Tourdias [1, 2]







(1) Service de NeuroImagerie Diagnostique et Thérapeutique, CHU Bordeaux, Université de Bordeaux
(2) Neurocentre Magendie, INSERM U 862, Université de Bordeaux

université de BORDEAUX
Inserm
Institut national
de la santé et de la recherche médicale
CHU
Hôpitaux de
Bordeaux

Une forte actualité thérapeutique

INJECTION

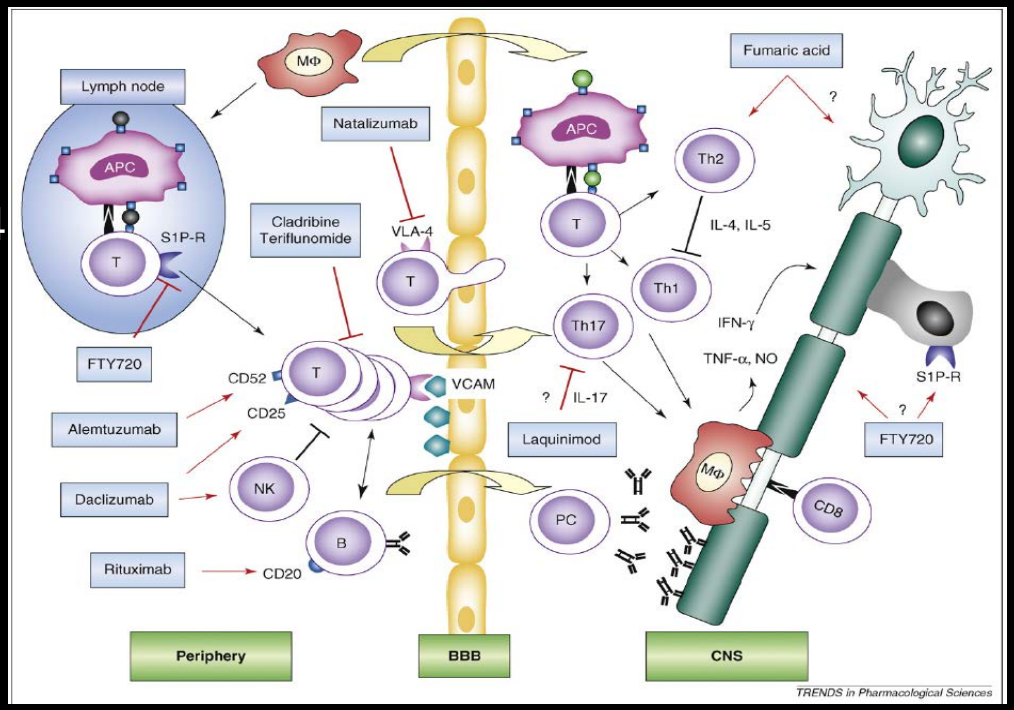
- Glatiramere acetate (Copaxone®) – 1996
- Interferon β-1a (Avonex®) – 1996
- Interferon β-1a (Rebif®) – 1998
- Interferon β-1b (Betaseron®) – 1993
- Interferon β-1b (Extavia®) – 2009
- Interferon β-1a pegylé (Plegridy®) – 2014

ORAL

- Dimethyl fumarate (Tecfidera®) – 2013
- Finfolimod (Gilenya®) – 2010
- Teriflunomide (Aubagio®) – 2012

PERFUSION

- Alemtuzumab (Lemtrada®) – 2014
- Mitoxantrone (Novantrone®) – 2000
- Natalizumab (Tysabri®) - 2006



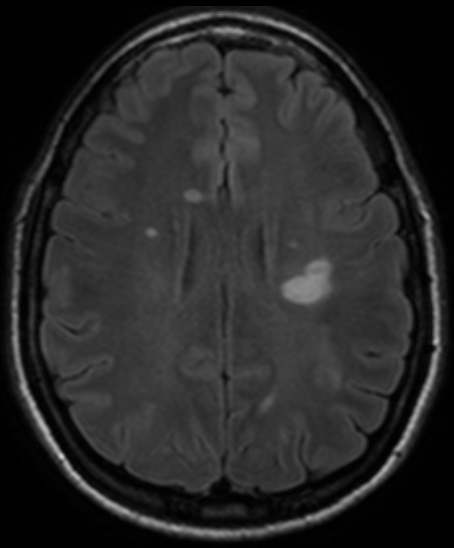
Plan:

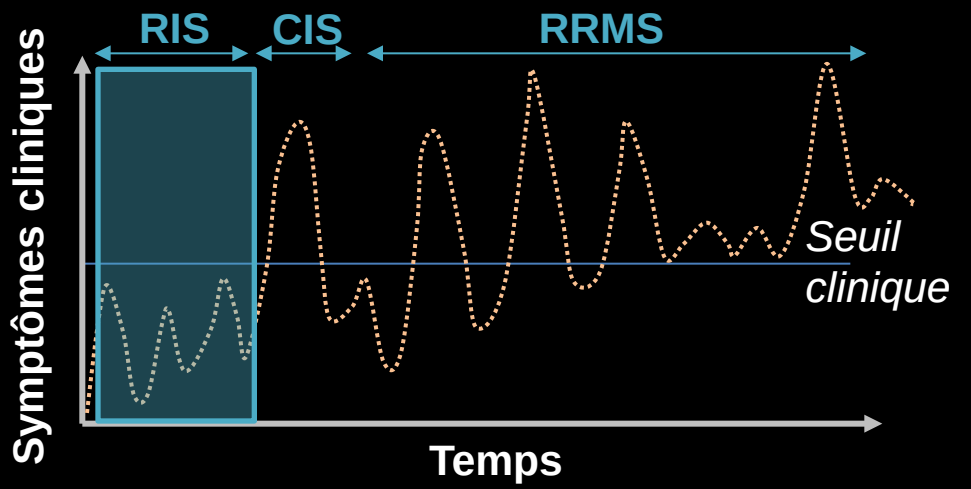
1. Le diagnostic précoce et le diagnostic différentiel
2. Nouvelle classification phénotypique des patients SEP
3. Les nouveaux marqueurs en imagerie: cortex et méninge

Diagnostic précoce

Le syndrome radiologiquement isolé – “RIS”

Découverte fortuite en IRM de lésions “SEP-like” chez un sujet asymptomatique



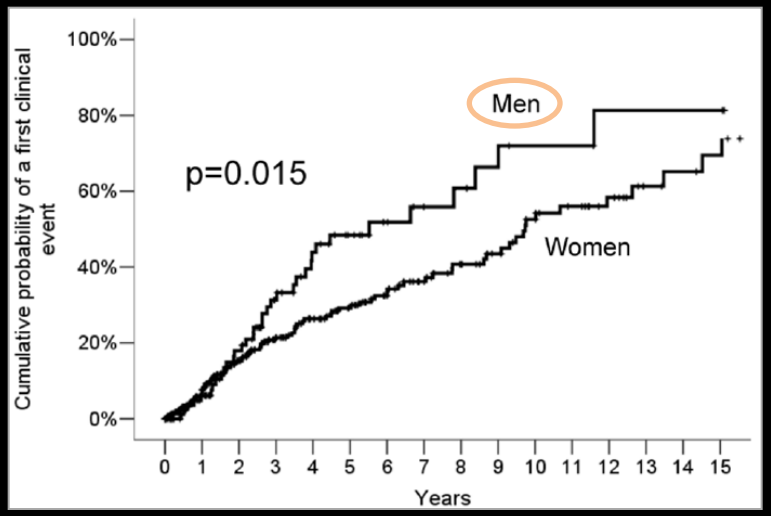


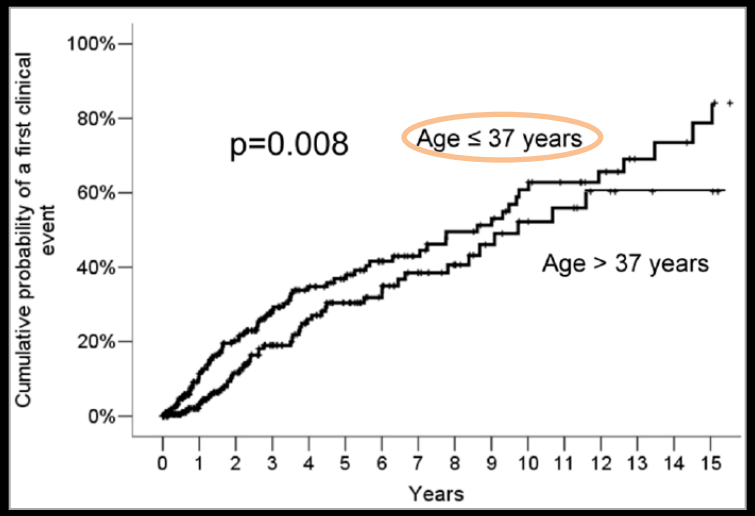
Okuda *et al.* Neurology 2009; 72:800-805

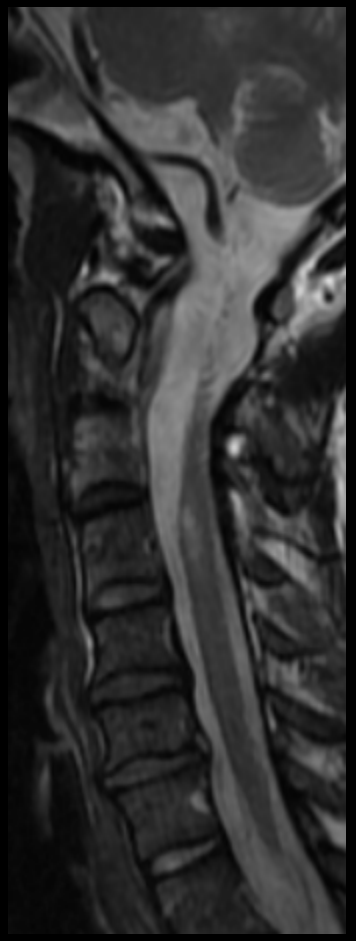
Diagnostic précoce

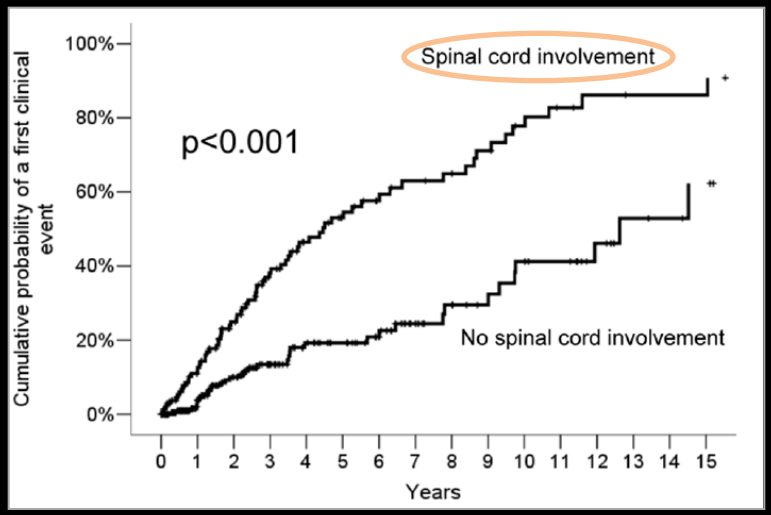
Le syndrome radiologiquement isolé – “RIS”

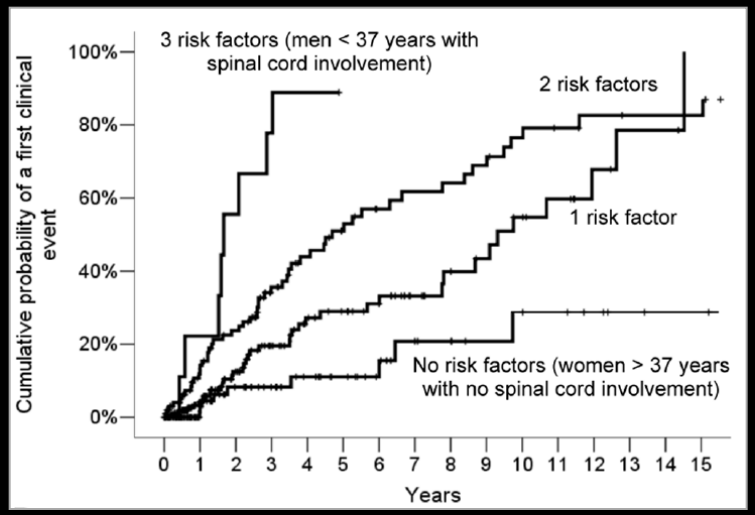
- 451 sujets avec un syndrome radiologiquement isolé – Suivi ~5ans











Okuda *et al.* PlosOne 2014; Mar 5;9(3):e90509

Diagnostic précoce

Le syndrome radiologiquement isolé – “RIS”

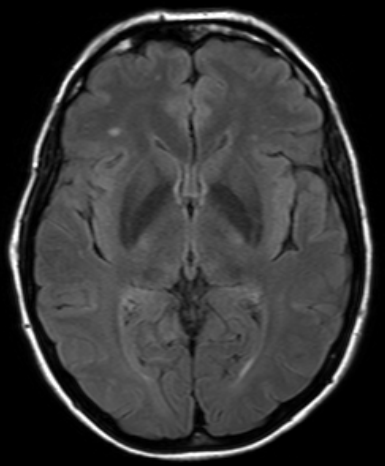
1. Découverte fortuite d’anomalies IRM lors d’un examen réalisé en l’absence de signe clinique de SEP (céphalées, volontaire sain)
2. Lésions de la substance blanche
   - •Ovoïdes ou bien circonscrites avec ou sans atteinte du corps calleux
   - •Ne ressemblant pas à une atteinte micro vasculaire
   - •Remplissant les critères de dissémination dans l’espace

Okuda *et al.* Neurology 2009; 72:800-805

Migraine is associated with an increased risk of deep white matter lesions, subclinical posterior circulation infarcts and brain iron accumulation:

The population-based MRI CAMERA-study

Cephalalgia. 2010 February ; 30(2): 129–136.

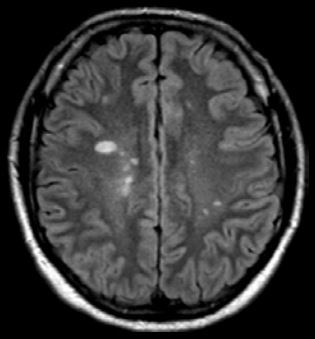


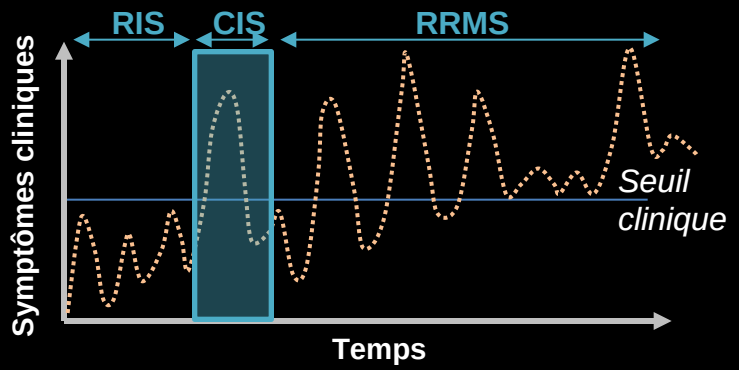
•Explorer la moelle

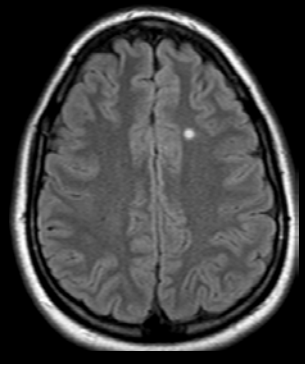
•Stratégie à définir: ”Wait” -“Follow” - “Treat”?

Diagnostic précoce

Orientation face à un syndrome cliniquement isolé – “CIS”







•Présentation clinique --> TYPIQUE
•IRM --> remplissant les critères

•Présentation clinique --> ATYPIQUE
•IRM --> Non spécifique

Diagnostic Criteria for Multiple Sclerosis: 2010 Revisions to the McDonald Criteria

Chris H. Polman, MD, PhD,[1] Stephen C. Reingold, PhD,[2] Brenda Banwell, MD,[3] Michel Clanet, MD,[4] Jeffrey A. Cohen, MD,[5] Massimo Filippi, MD,[6] Kazuo Fujihara, MD,[7] Eva Havrdova, MD, PhD,[8] Michael Hutchinson, MD,[9] Ludwig Kappos, MD,[10] Fred D. Lublin, MD,[11] Xavier Montalban, MD,[12] Paul O'Connor, MD,[13] Magnhild Sandberg-Wollheim, MD, PhD,[14] Alan J. Thompson, MD,[15] Emmanuelle Waubant, MD, PhD,[16] Brian Weinshenker, MD,[17] and Jerry S. Wolinsky, MD[18]

New evidence and consensus has led to further revision of the McDonald Criteria for diagnosis of multiple sclerosis. The use of imaging for demonstration of dissemination of central nervous system lesions in space and time has been simplified, and in some circumstances dissemination in space and time can be established by a single scan. These revisions simplify the Criteria, preserve their diagnostic sensitivity and specificity, address their applicability across populations, and may allow earlier diagnosis and more uniform and widespread use.

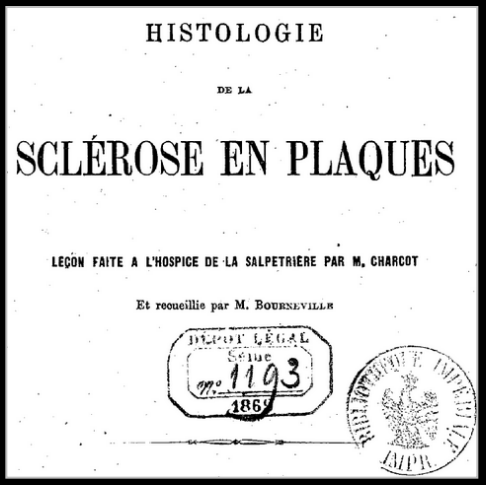
ANN NEUROL 2011;69:292–302

•Examens para cliniques:
- •Ponction lombaire
- •Potentiels évoqués
- •Auto-anticorps
- •Sérologies
- •TDM corps entier
- •Biopsies (peau, glandes salivaires, méninge….)
- •……..

•Suivi

Diagnostic précoce

Orientation face à un syndrome cliniquement isolé – “CIS”


HISTOLOGIE

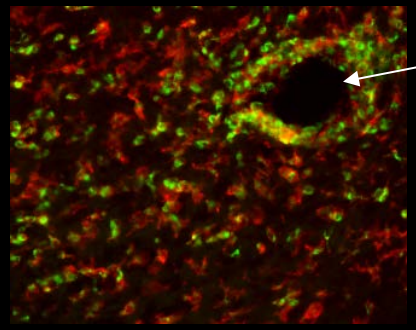
DE LA

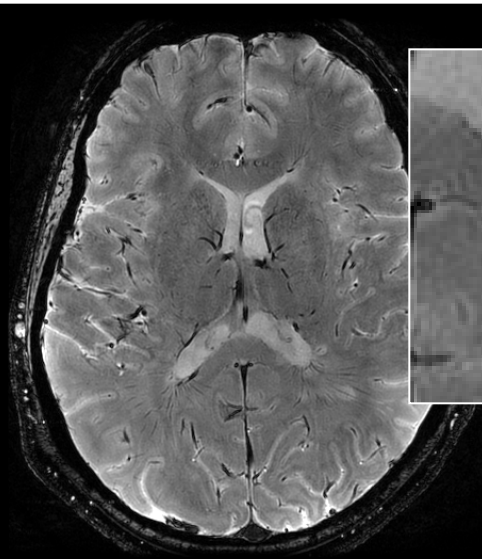
SCLÉROSE EN PLAQUES

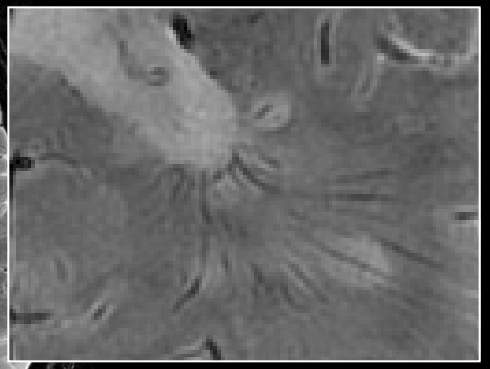
LEÇON FAITE A L'HOSPICE DE LA SALPETRIÈRE PAR M. CHARCOT

Et recueillie par M. BOURNEVILLE

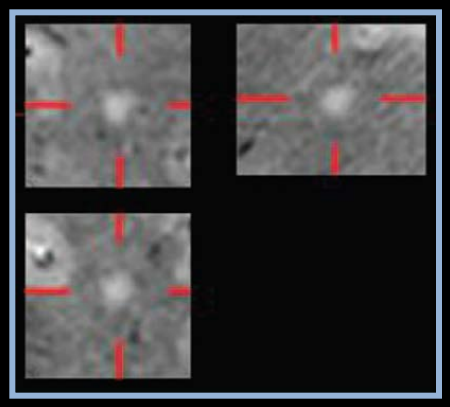
DÉPÔT LÉGAL
Seine
n° 1193
1869

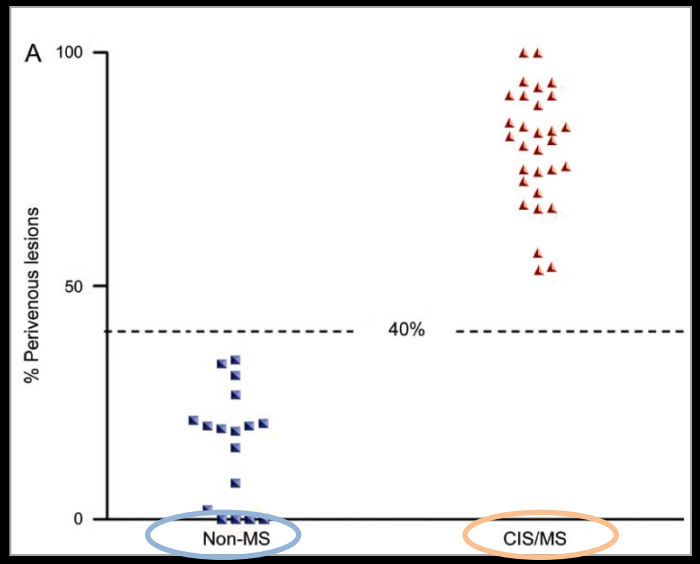


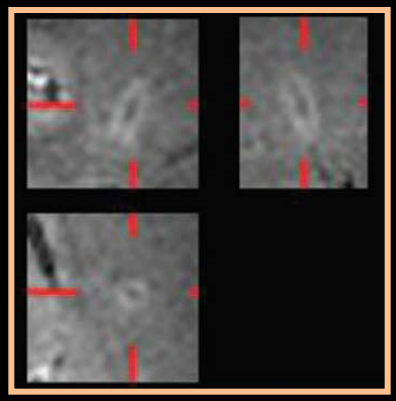




7Tesla, T2*FSPGR







Tallantyre *et al.* Neurology 2011; 76:534-39

Diagnostic précoce

Orientation face à un syndrome cliniquement isolé – “CIS”

Critères d’inclusion

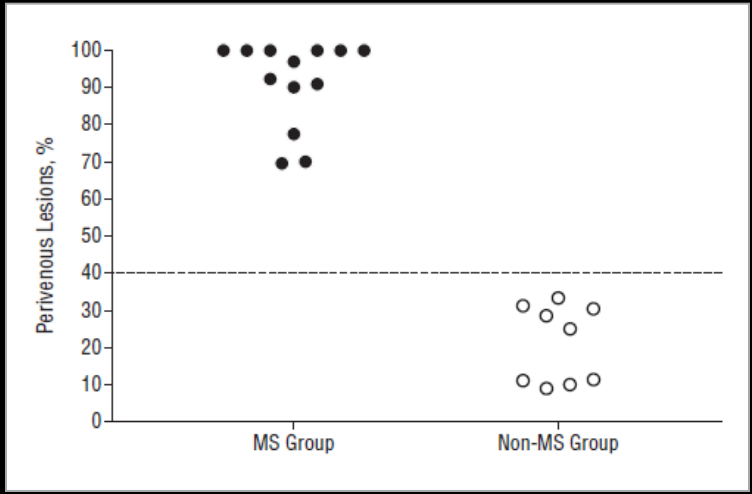
- Lésions de la SB sans diagnostic
- Prospectif
- Consécutif
- 29 patients

Méthodes évaluées

- IRM 7T : séquence T2*
- Deux lecteurs
- En aveugle du diagnostic final

Gold standard: diagnostic

- Examens para-cliniques
- Suivi (26 mois)



Mistry *et al.* JAMA Neurology 2013; 70:623-8

Diagnostic précoce

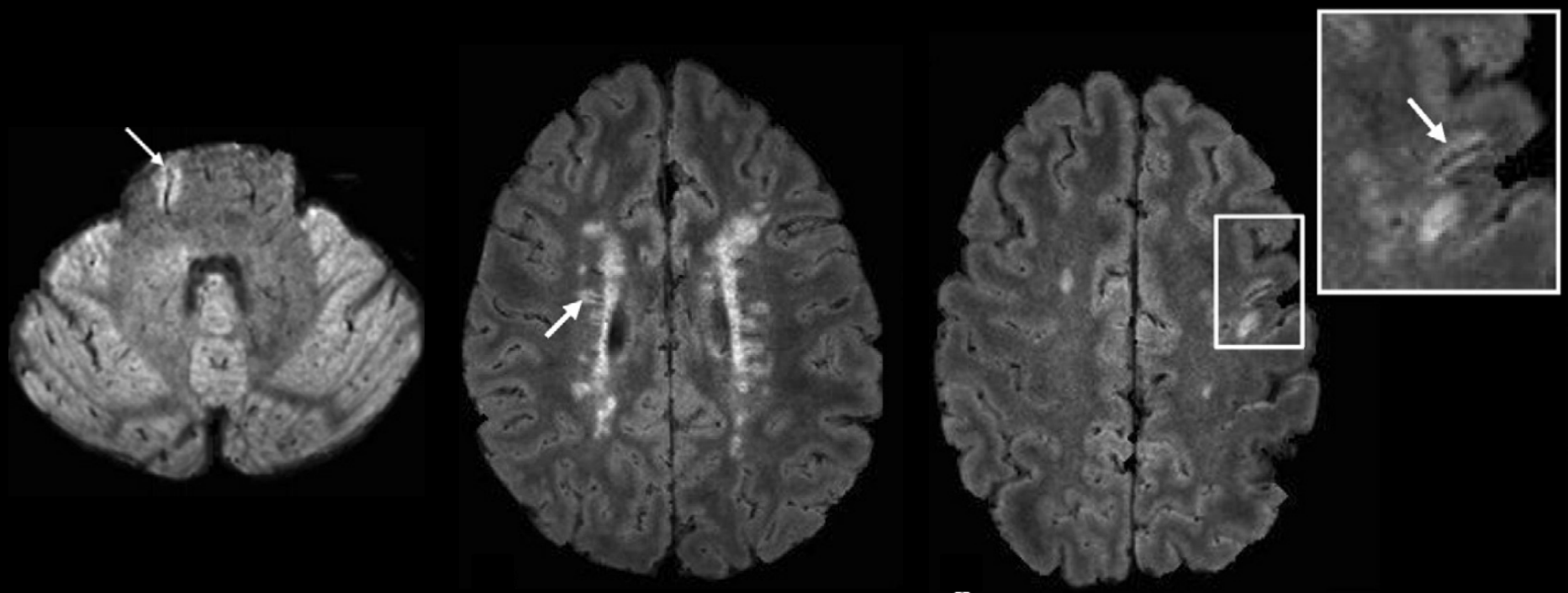
Orientation face à un syndrome cliniquement isolé – “CIS”

FLAIR*: A Combined MR Contrast Technique for Visualizing White Matter Lesions and Parenchymal Veins[1]

Radiology

Sati *et al.* Radiology 2012; 265:926-32

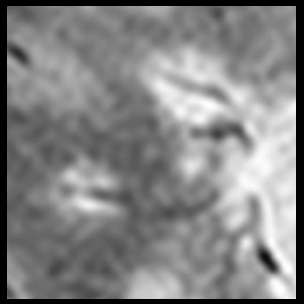
FLAIR*
=
FLAIR
X
T2* per gadolinium



Diagnostic précoce

Orientation face à un syndrome cliniquement isolé – “CIS”

“White matter lesion central veins: an inter-scanner comparison of patients with MS and ischemic lesions at 3T MRI”.
Samaraweera *et al.* ECTRIMS, Boston, Septembre 2014



“FLAIR* for the non-invasive histological diagnosis of MS at 3T MRI”.
Campion *et al.* ECTRIMS, Boston, Septembre 2014

frontiers in NEUROLOGY

MINI REVIEW ARTICLE
published: 22 July 2013
doi: 10.3389/fneur.2013.00098

Venocentric lesions: an MRI marker of MS?

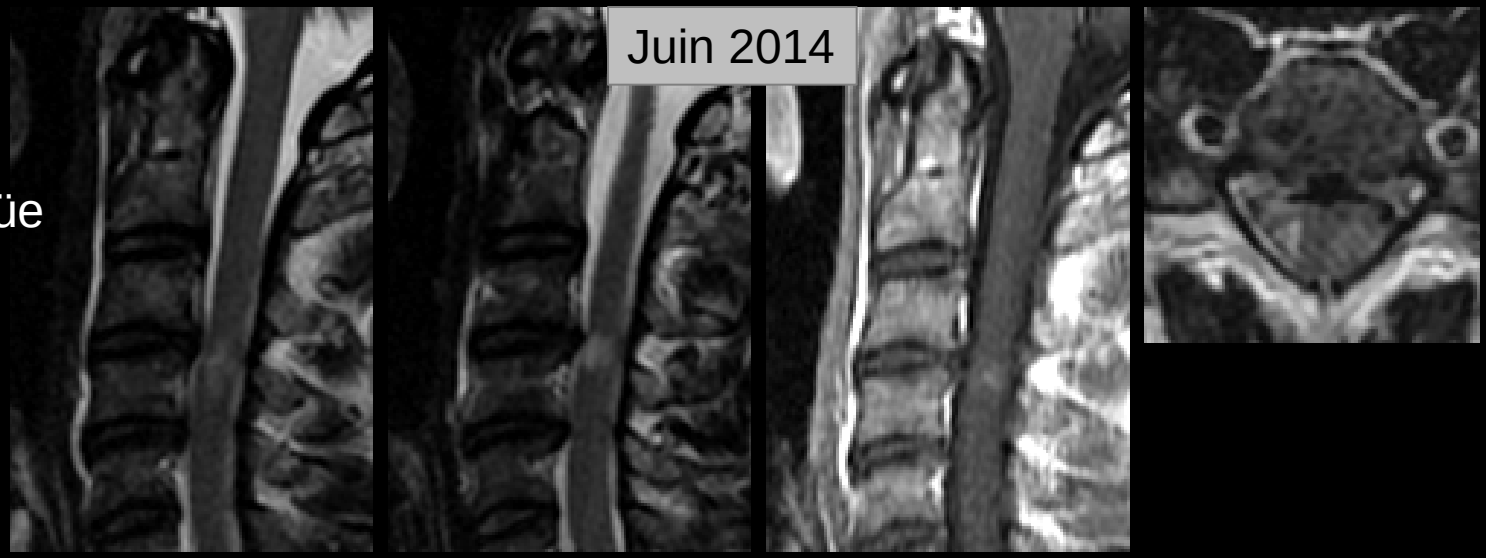
***Matthew P. Quinn*[1,2], *Marcelo Kremenchutzky*[3]* *and Ravi S. Menon*[1,2]**

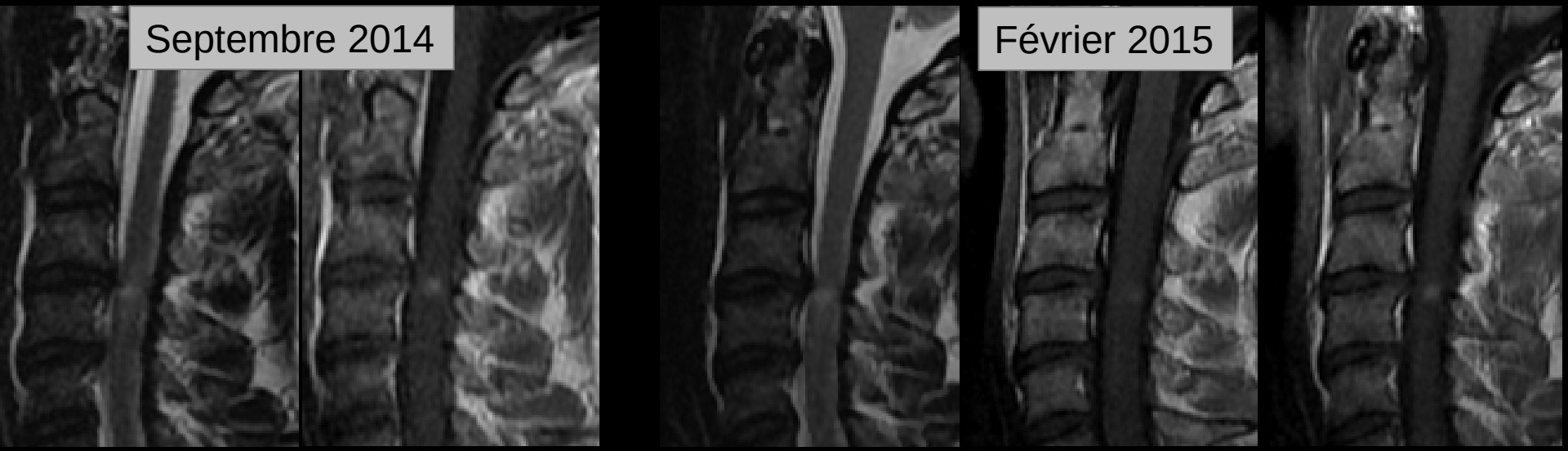
[1] *Department of Medical Biophysics, Schulich School of Medicine and Dentistry, The University of Western Ontario, London, ON, Canada*
[2] *Centre for Functional and Metabolic Mapping, Robarts Research Institute, The University of Western Ontario, London, ON, Canada*
[3] *Department of Clinical Neurological Sciences, London Health Sciences Centre, The University of Western Ontario, London, ON, Canada*

Diagnostic précoce

Sémiologie des lésions médullaires

- Homme 42 ans,
- Installation subaigüe
- Myélite,
- Lhermitte





Diagnostic précoce

Sémiologie des lésions médullaires

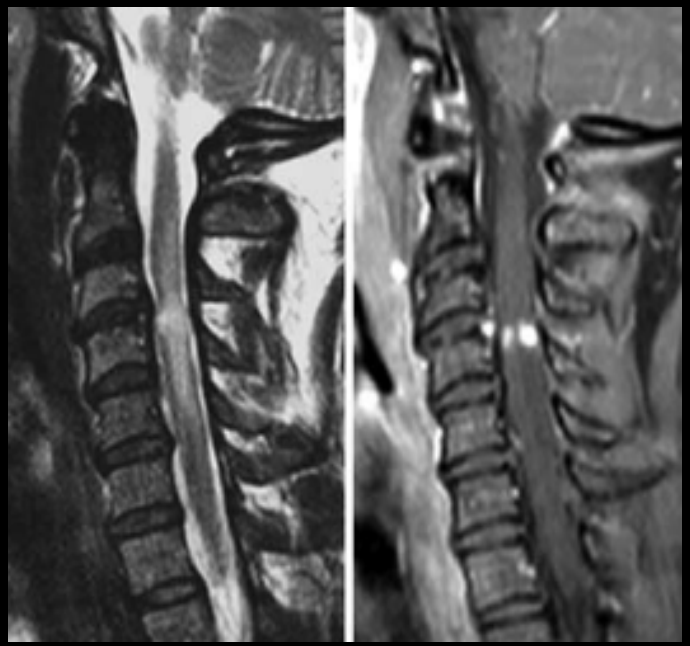
RESEARCH ARTICLE

Specific Pattern of Gadolinium Enhancement in Spondylotic Myelopathy

- 56 patients avec une myélopathie cervico-arthrosique opérée
- Avec un rehaussement post-gadolinium
- Jamais retrouvé dans un groupe de 136 myelites rehaussées d'autre origine

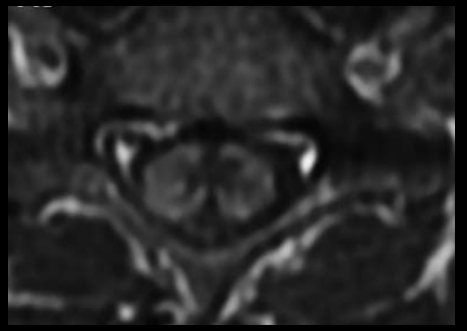
- "Pancake-like" sous le site de la sténose
- Epargnant le gris en axial (57% des cas)
- Persistant à 12 mois (75% des cas)

Sagital T2 *Sagital T1 Gado*



Sagital T2 *Sagital T1 Gado*

Axial T1 Gado



Flanagan *et al.* Ann Neurol 2014; 76:54-65

Plan:

1. Le diagnostic précoce et le diagnostic différentiel
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    - Sémiologie des lésions de la SB – “veino-centrique”
    - Sémiologie des lésions médullaires
2. Nouvelle classification phénotypique des patients SEP
3. Les nouveaux marqueurs en imagerie: cortex et méninge

Nouvelle classification phénotypique des patients SEP

Classification radio-clinique

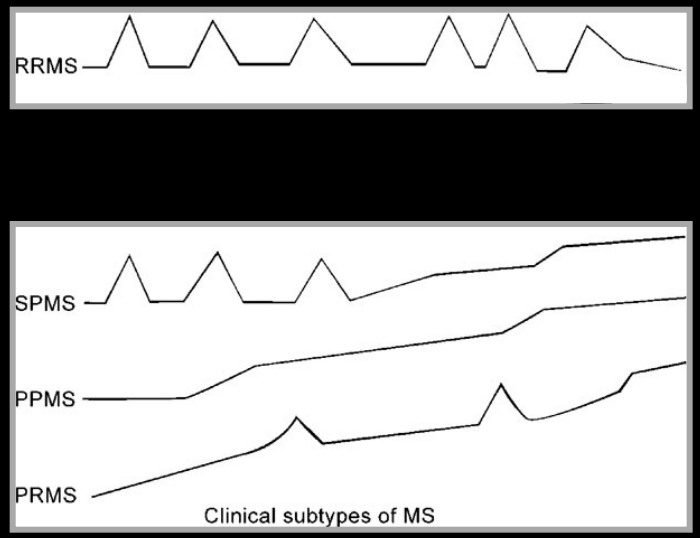
VIEWS & REVIEWS

Defining the clinical course of multiple sclerosis

The 2013 revisions

Lublin *et al.* Neurology 2014; 83:278-86

Phénotype SEP Version 1996



Phénotype SEP Révision 2013

RRMS
- Active *
- Non active

Forme progressive (SP ou PP)
- Active et avec progression**
- Active sans progression
- Non active mais avec progression
- Non active sans progression (maladie stable)

**: clinique et/ou IRM (nouvelle lésion T2, gadolinium)
**: clinique

Nouvelle classification phénotypique des patients SEP

Classification radio-clinique

VIEWS & REVIEWS

Defining the clinical course of multiple sclerosis

The 2013 revisions

Lublin *et al.* Neurology 2014; 83:278-86

There was consensus among the group that clinical assessments for activity and progression should be dictated by individual disease evolution, but should occur at least annually. Annual brain MRI scanning for activity in relapsing forms of MS was believed to be useful.

REVIEW

OFSEP, a nationwide cohort of people with multiple sclerosis: Consensus minimal MRI protocol

Cotton *et al.* J Neuroradiol 2015; Feb 5 [Epub ahead of print]

The full OFSEP MRI protocol acquisition frequency is set to at least one every three years. However, it should not be con-

Nouvelle classification phénotypique des patients SEP

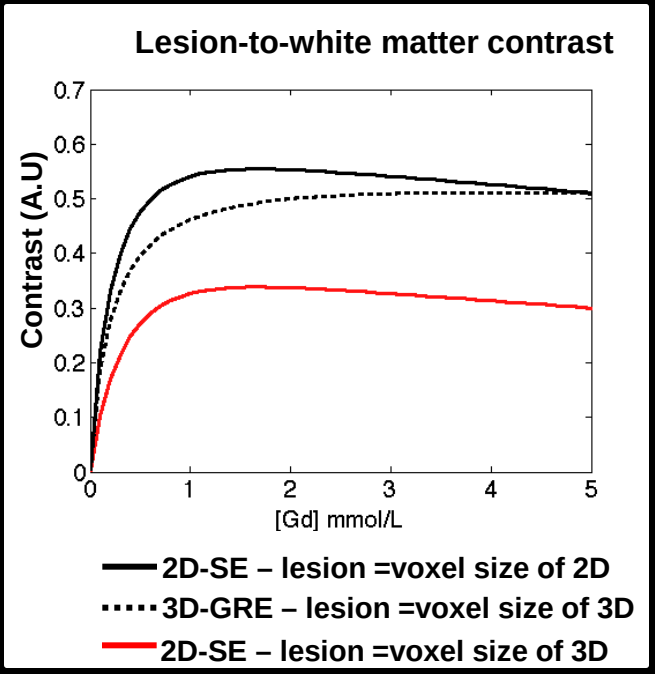
Classification radio-clinique

RECOMMANDATIONS OFSEP

- 3D T1 sans injection
- Diffusion
- 3D T2

Injection

- 3D FLAIR
- 3D T1 post injection



ORIGINAL RESEARCH
BRAIN

MS Lesions Are Better Detected with 3D T1 Gradient-Echo Than with 2D T1 Spin-Echo Gadolinium-Enhanced Imaging at 3T

A. Crombé, M. Saranathan, A. Ruet, M. Durieux, E. de Roquefeuil, J.C. Ouallet, B. Brochet, V. Dousset, and T. Tourdias

AJNR Am J Neuroradiol 36:501–07 Mar 2015 www.ajnr.org

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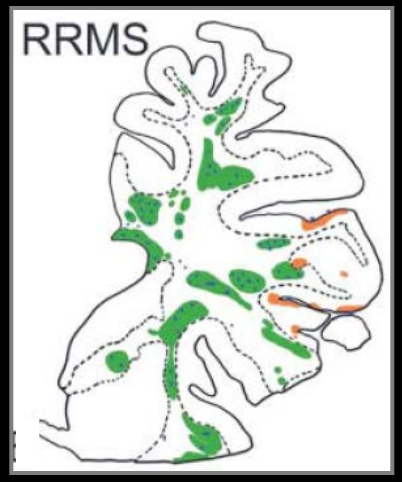
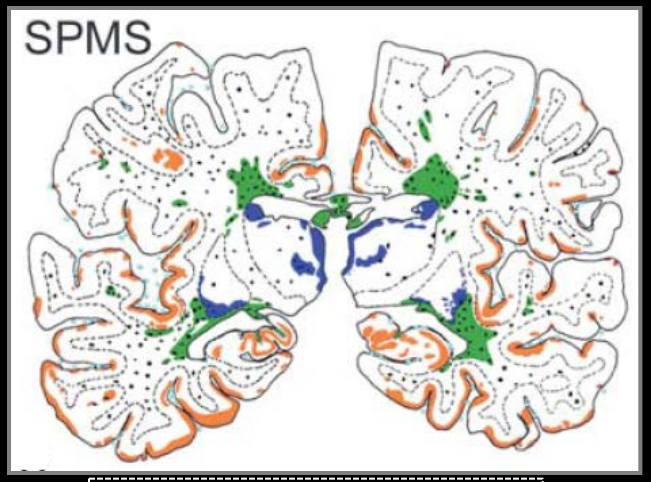
    - Sémiologie des lésions médullaires
2. Nouvelle classification phénotypique des patients SEP
    - Phénotype radio-clinique: maladie active / non-active
    - Suivi régulier – protocole OFSEP
3. Les nouveaux marqueurs en imagerie: cortex et méninge

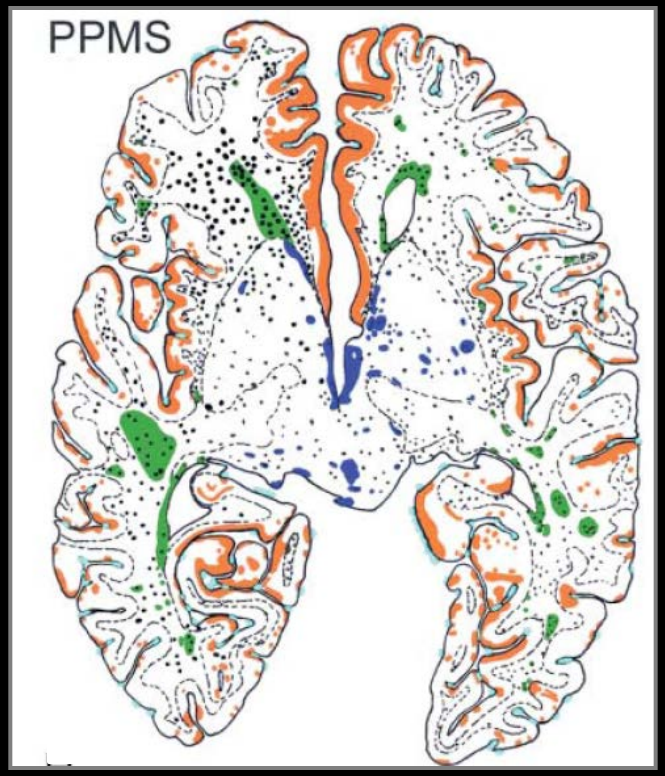
Les nouveaux marqueurs en imagerie

Cortex





Lésions focales de la SB
Lésions corticales
Noyaux gris centraux



Kutzelnigg *et al.* Ann Neurol 2005; 128:2705-12

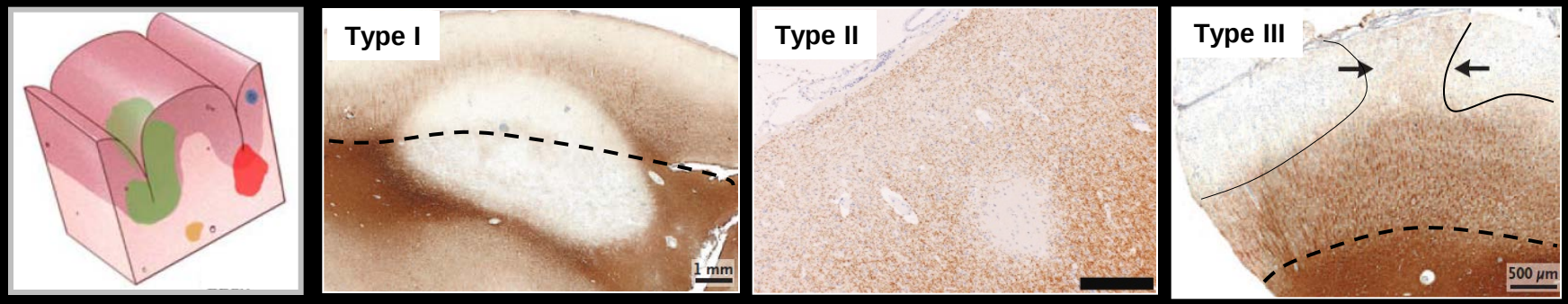
- L'atteinte de la SG est précoce.

- L'atteinte de la SG progresse et devient prédominante dans les formes progressives.
  - Démyélinisation dans les formes progressive: SG 28.8% *vs.* SB 15.6%

Glimore *et al.* JNNP 2009; 80:182-87

Les nouveaux marqueurs en imagerie

Cortex



Lucchinetti *et al.* NEJM 2011; 365:2188-97

- Sensibilité --> *TRES FAIBLE!!*
  - = 18%
  - >80% des lésions corticales non vues

Seewann *et al. Neurology* 2012; 78:302-8

- L'atteinte du gris contribue à ***l'incapacité physique*** (EDSS) et aux troubles cognitifs de façon plus significative que les lésions de la SB.

Geurts *et al.* Lancet Neurol 2012; 11:1082-92

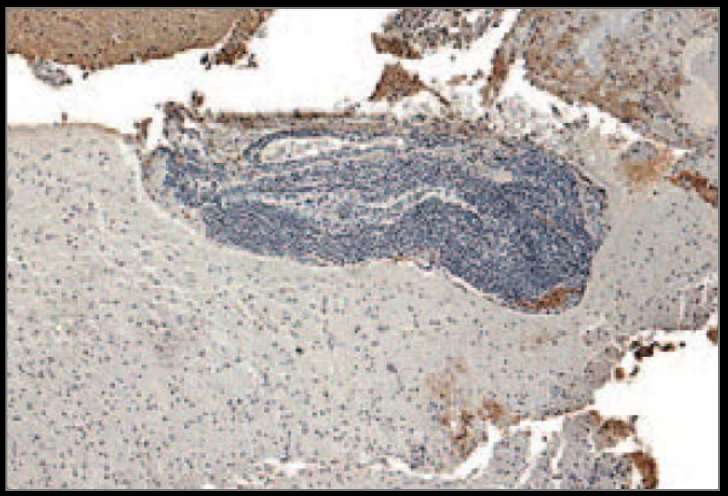
Les nouveaux marqueurs en imagerie

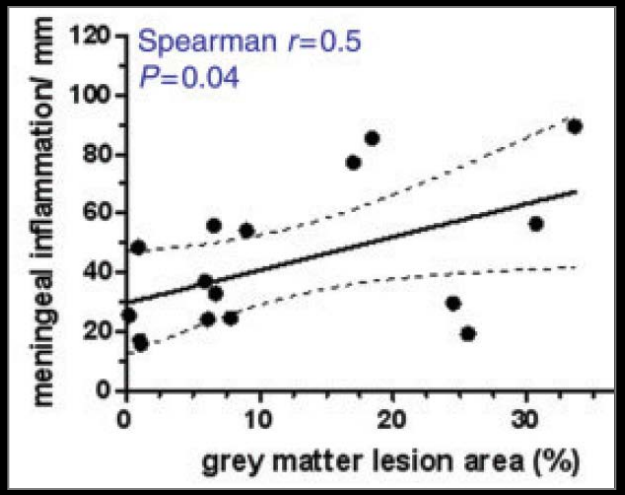
Méninge

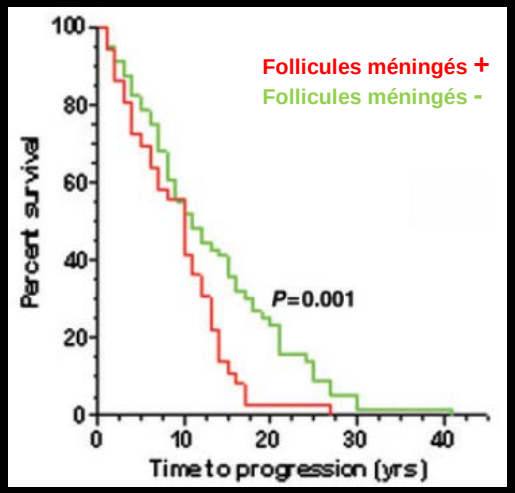
BRAIN
A JOURNAL OF NEUROLOGY

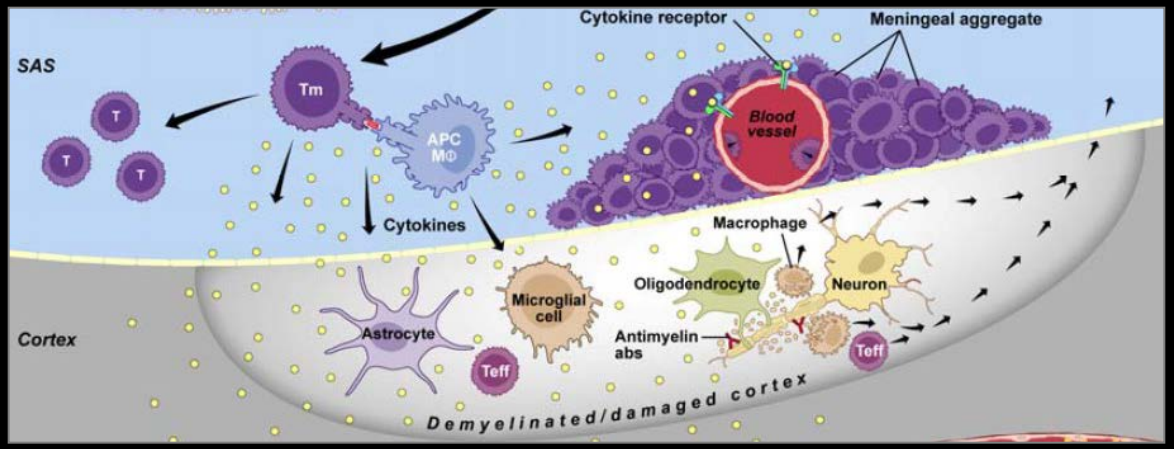
Meningeal inflammation is widespread and linked to cortical pathology in multiple sclerosis

- Lucchinetti *et al.* NEJM 2011 — 138 biopsies corticales – formes RR
- Howell *et al.* Brain 2011 — 123 cas autopsiques – formes SP
- Choi *et al.* Brain 2012 — 26 cas autopsiques – formes PP





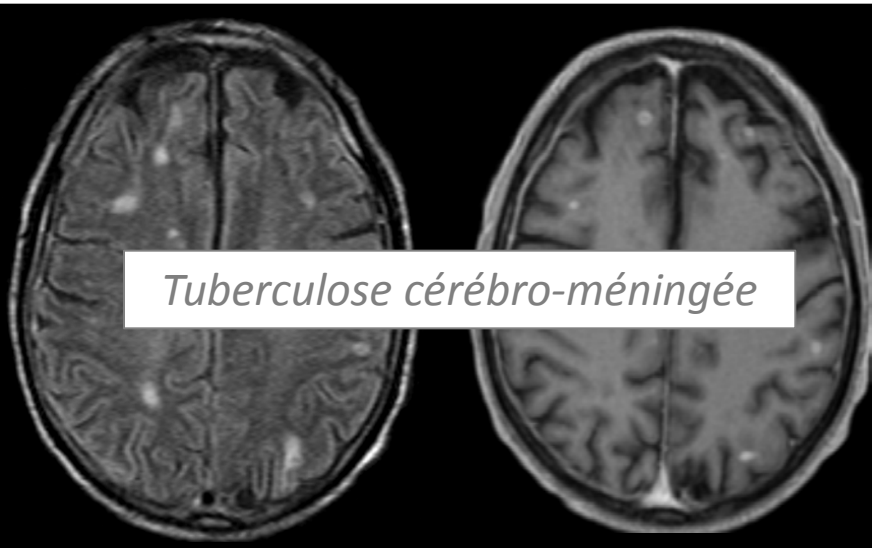




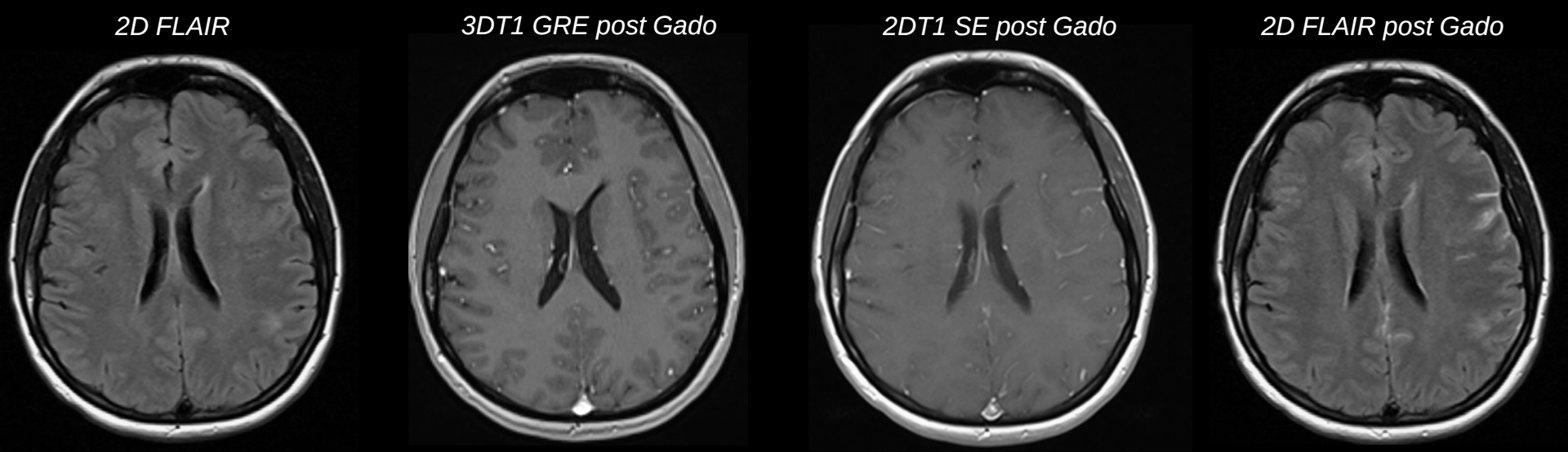
Les nouveaux marqueurs en imagerie

Méninge

- La PDC méningée est un signe d'alerte ("red flag") qui oriente vers un diagnostic autre que celui de SEP



- Intérêt du FLAIR-Gado pour visualiser les PDC méningées subtiles?



Les nouveaux marqueurs en imagerie

Méninge

ARTICLES

Investigation of leptomeningeal enhancement in MS

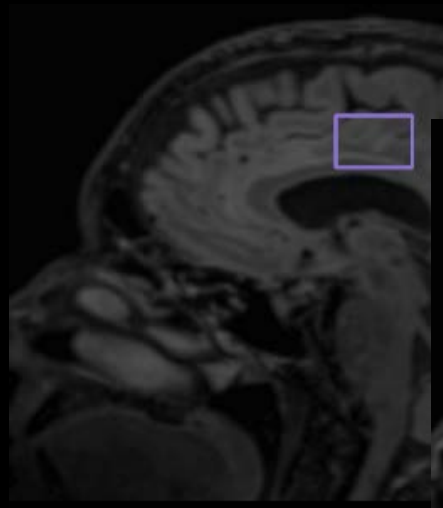
A postcontrast FLAIR MRI study

Eisele *et al.* Neurology2015; 84:770-5

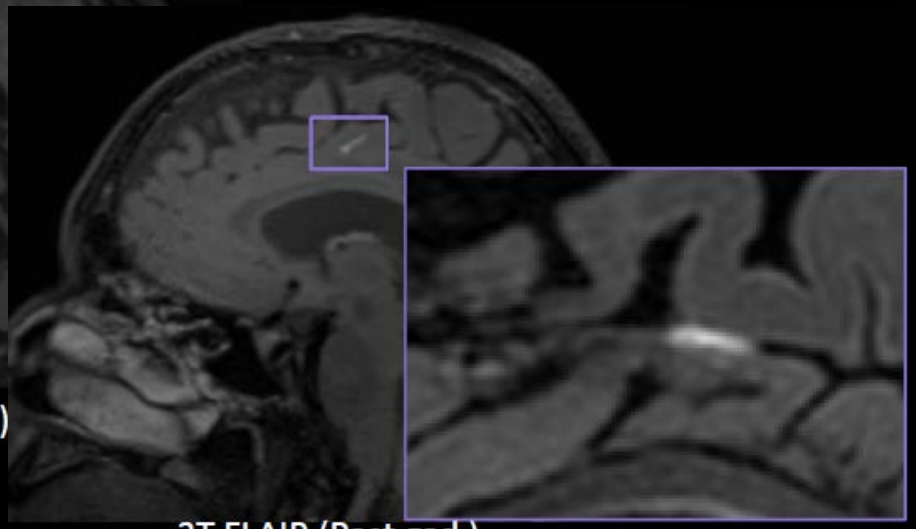
- Une seule(!!) PDC méningée sur 112 patients
- Mais 15 formes progressives uniquement

- 84 cas avec rehaussement leptomeningé sur 330 patients: 25% - 34% des formes progressives

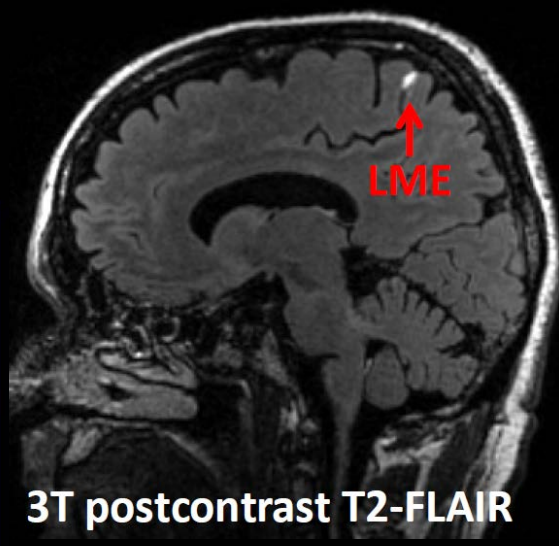
Reich *et al.* ANN, Philadelphia, Avril 2014



3T FLAIR (Pre gad)



3T FLAIR (Post gad)



3T postcontrast T2-FLAIR

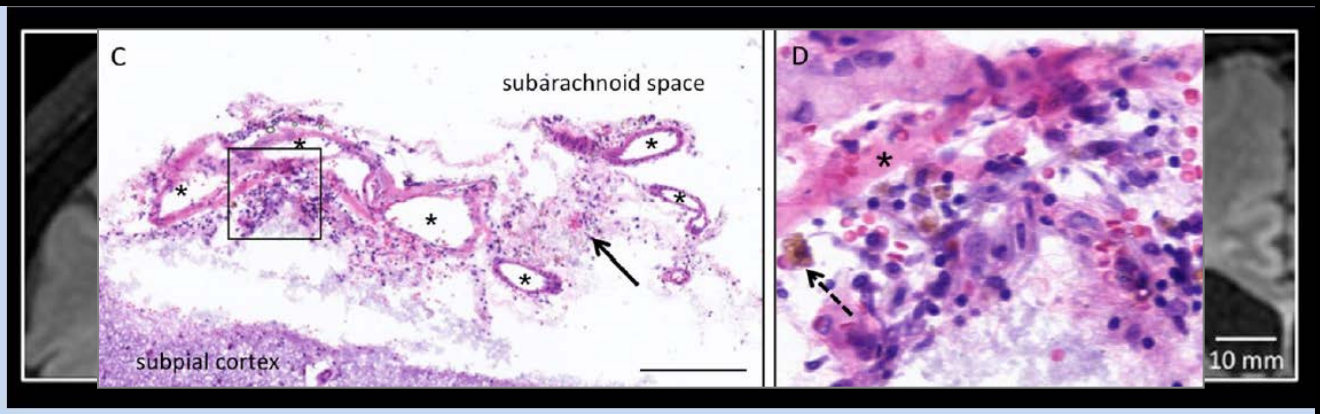
Les nouveaux marqueurs en imagerie

Méninge

In vivo

MS Patient#1
59-year-old male
progressive MS
EDSS 6.5
disease duration 21 ys

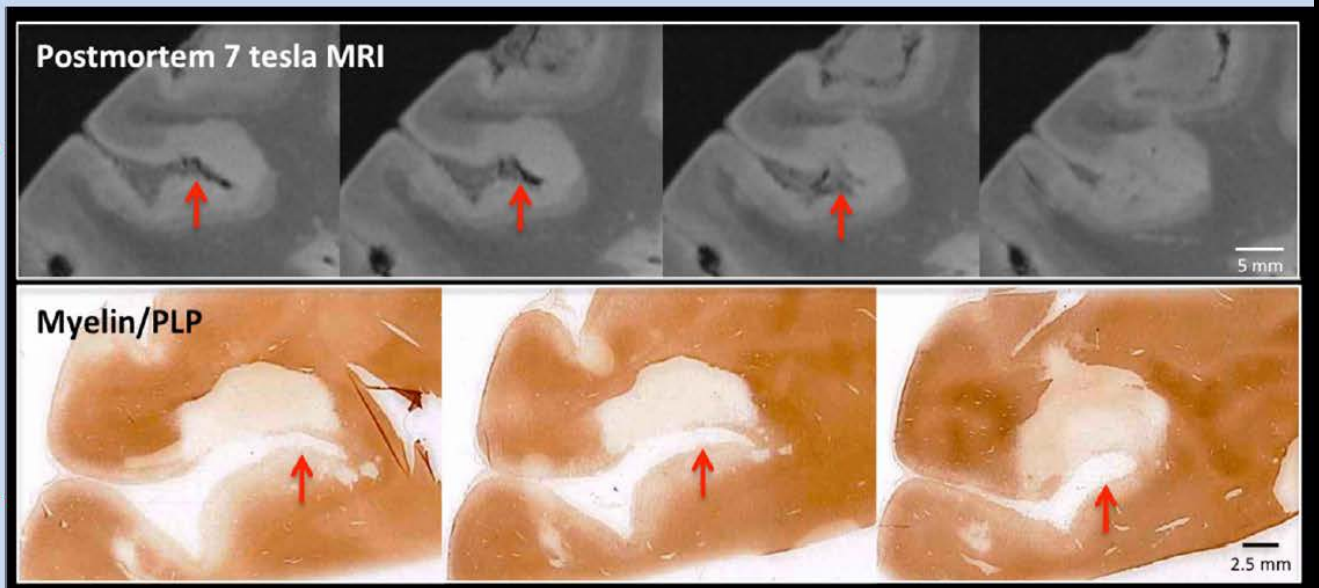
Infratentorial stroke



Autopsy
(June 2013)

Postmortem

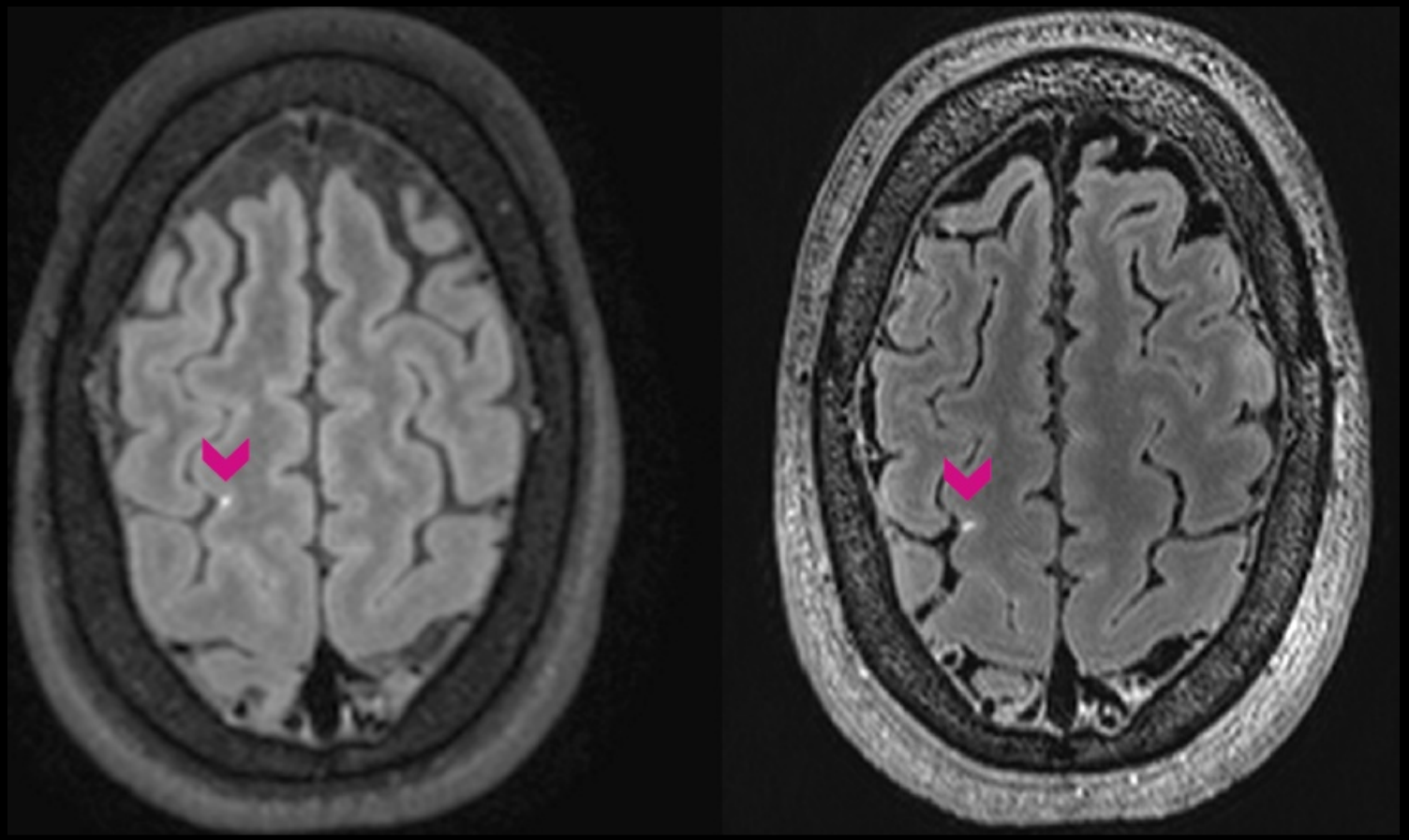
extensive
cortical demyelination



Absinta M *et al.* ECTRIMS, Boston, Septembre 2014

Les nouveaux marqueurs en imagerie

Méninge



3T-FLAIR (post-gad)
Voxel resolution: 1x1x1 mm³

7T-FLAIR (post-gad)
Voxel resolution: 0.8x0.8x0.8 mm³

Vuolo L *et al.* ECTRIMS, Boston, Septembre 2014

Les nouveaux marqueurs en imagerie

Méninge

ClinicalTrials.gov

A service of the U.S. National Institutes of Health

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A Phase 1 Trial of Intrathecal Rituximab for Progressive Multiple Sclerosis Patients

Inclusion Criteria:

- Diagnosis of PPMS by revised McDonald criteria or SPMS by Lublin and Reingold criteria
- Age ≥ 18 years
- MRI Brain demonstrating evidence of leptomeningeal enhancement on contrast enhanced FLAIR images within the past 12 months, which is now part of the routine clinical MS MRI protocol at the Johns Hopkins Hospital.
- Patients may be on no MS treatment or should have been on the same treatment for at least 6 months and are not expected to switch therapy in the next 6 months

Conclusion

Patients

•Diagnostic précoce
•Suivi en imagerie
•Cortex, méninge

Traitements

MERCI…

Service de Neuroimagerie: Pr Dousset, Bordeaux

X.Barreau; J.Berge; E.De Roquefeuil; M.Durieux;
JP. Lafourcade, S. Molinier; P.Ménégon

Neurocentre Magendie INSERM U862; Dr Oliet, Bordeaux

FINANCIAL SUPPORT

TRAIL Cluster of excellence
TRANSLATIONAL RESEARCH AND ADVANCED IMAGING LABORATORY

BRAIN Cluster of excellence
BORDEAUX REGION AQUITAINE INITIATIVE FOR NEUROSCIENCES

arsep