FACULTÉ DE MÉDECINE
MONTPELLIER-NÎMES
DEPUIS 1220

Autogreffes de cellules souches:
Quel intérêt en neurologie?

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UNIVERSITÉ MONTPELLIER

inm institute for neurosciences montpellier

LEUKO FRANCE

Lyon – SFH – 29 janvier 2026

Conflits d’intérêts

Participation à des réunions, présentations, invitations à des conférences, financement de projets de recherche indépendants:

- **ALEXION, AMGEN, BIOGEN, GILEAD, JANSSEN, JUVISE, NOVARTIS, MERCK, ROCHE, SANOFI.**

Indication des greffes de CSH

- **Autologues**
  - **<u>Tumeurs malignes</u>**
    - NHL
    - Hodgkin’s disease
    - Leucémie aigue myéloïde
    - Myélome multiple
    - Tumeurs solides
  - **<u>Autres maladies</u>**
    - Maladies autoimmunes
- **Allogéniques**
  - **<u>Tumeurs malignes</u>**
    - NHL
    - Leucémie aigue myéloïde
    - Myélome multiple
    - Etc…
  - **<u>Autres maladies</u>**
    - Maladies génétiques
    - Etc…

NC Gorin Bull Ac Nat Med 2015

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Cellules malignes

Cellules défaillantes

- **Allogéniques**
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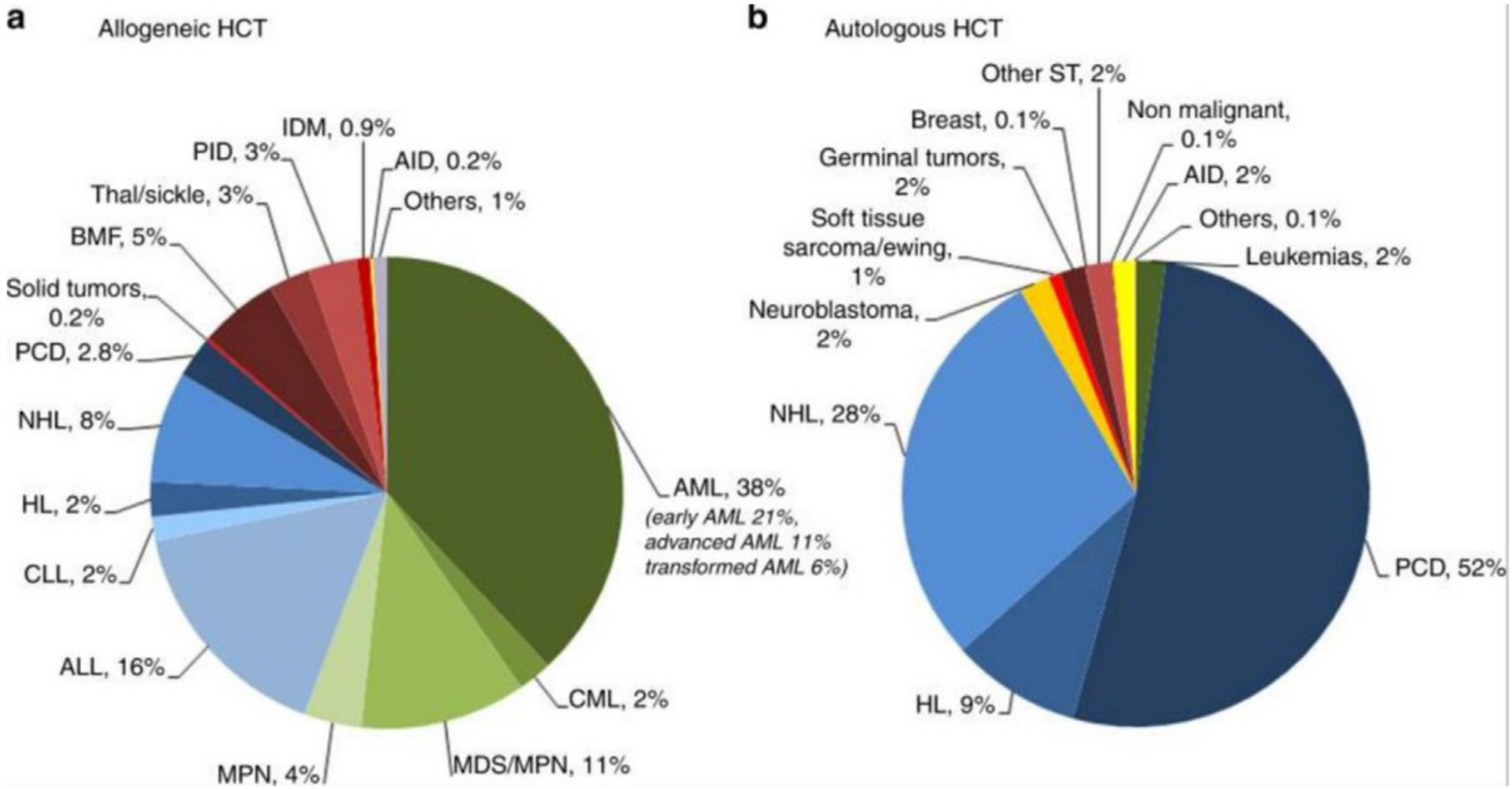
Cellules défaillantes

NC Gorin Bull Ac Nat Med 2015

Indication des greffes de CSH



NC Gorin Bull Ac Nat Med 2015
Pugnet Bull Can 2017

Indication des greffes de CSH

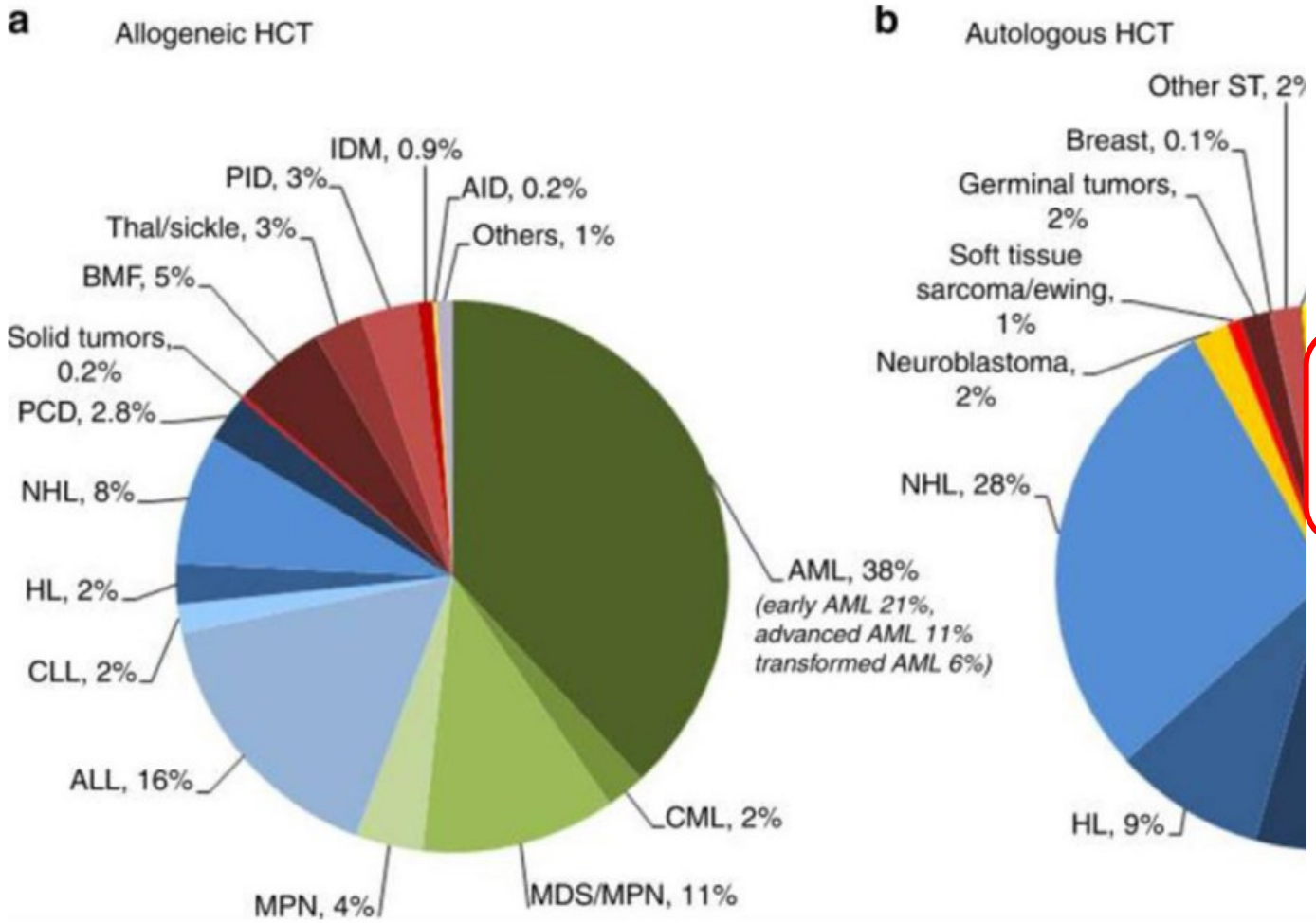


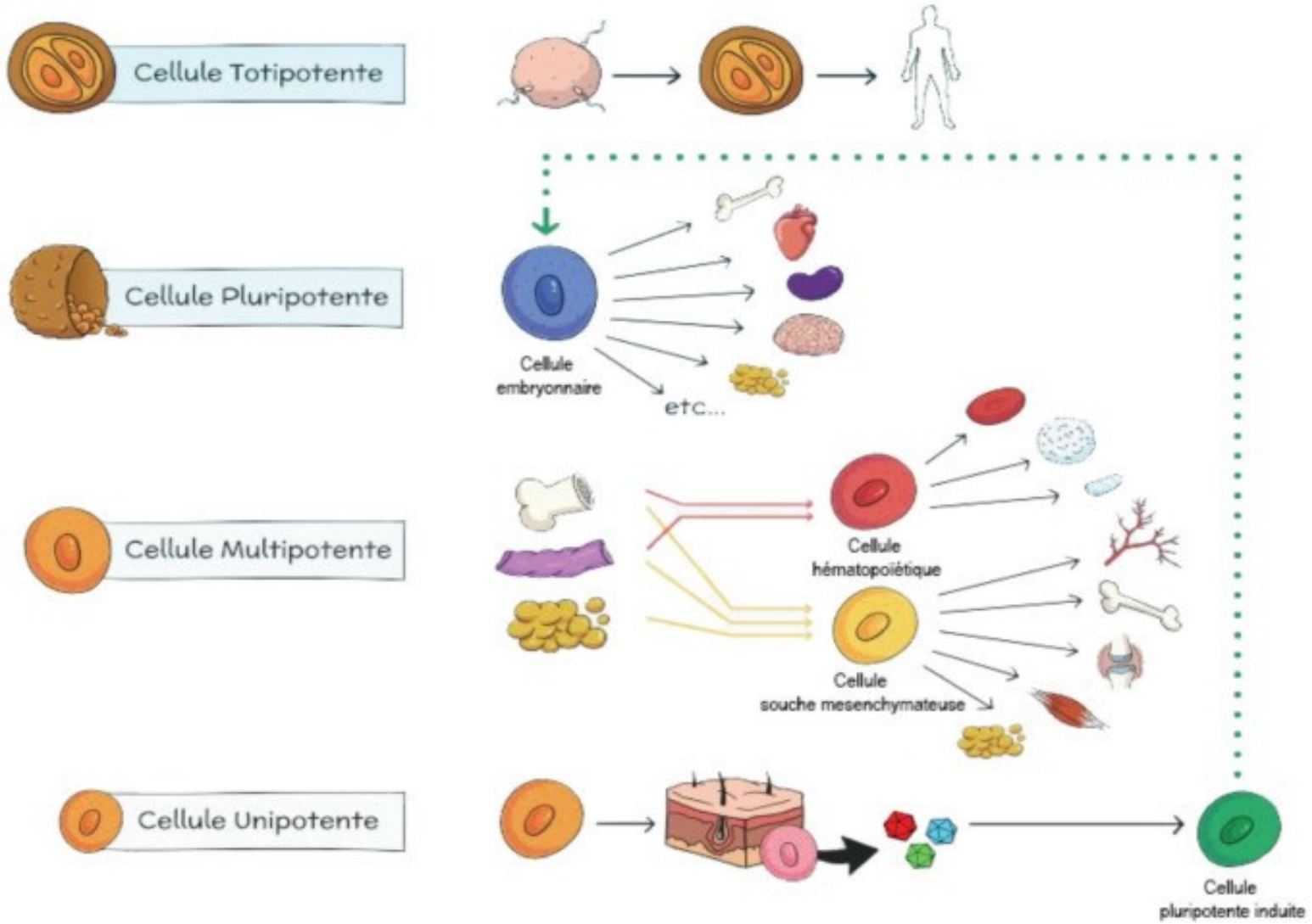
TABLEAU I

Nombre d'autogreffes de CSH pour MAI rapportées en France de 1996 à 2017

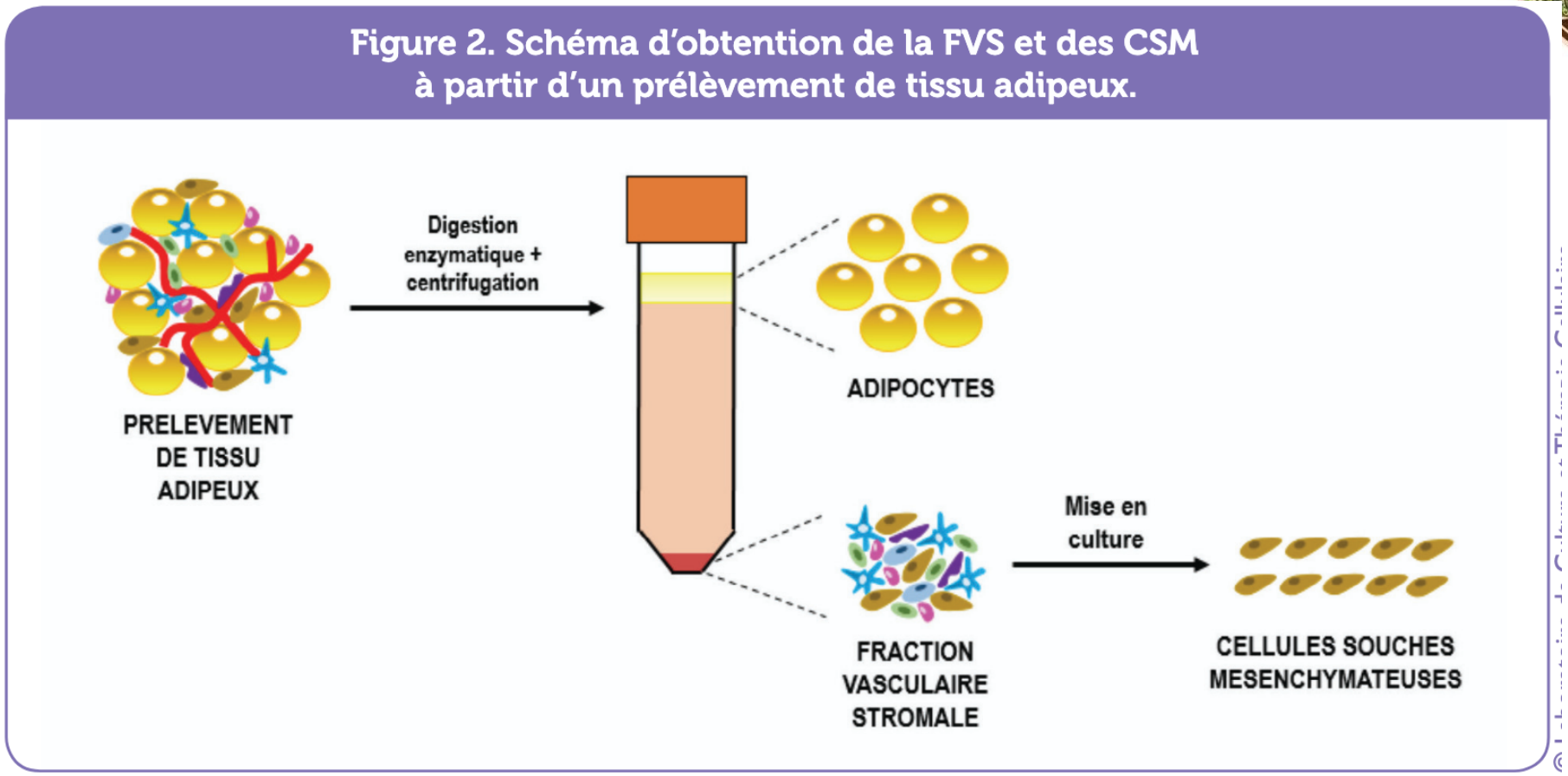
	n
Sclérodermie systémique	75
Dermatomyosites-polymyosites	6
Polychondrites	3
Lupus érythémateux disséminé	2
Sclérose en plaques	18
Polyradiculonévrite inflammatoire démyélinisante chronique	2
Autres MAI neurologiques	3
Cytopénies auto-immunes	11
Arthrite juvénile idiopathique	3
Polyarthrite rhumatoïde	2
Autres arthrites	3
Maladie de Crohn	5

NC Gorin Bull Ac Nat Med 2015
Pugnet Bull Can 2017

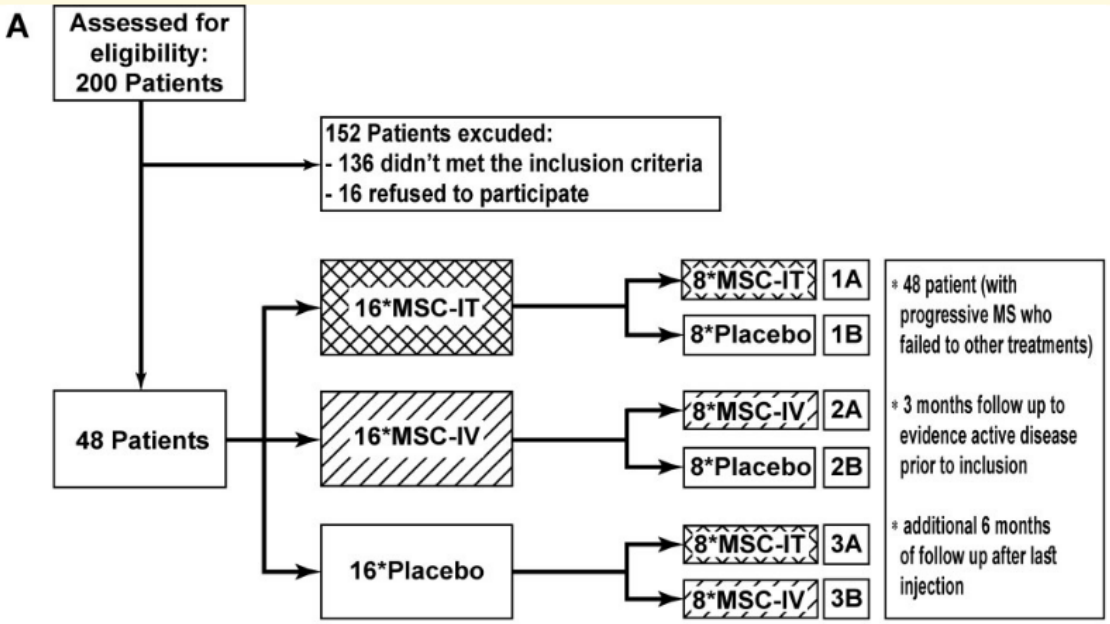
Cellules souches ???

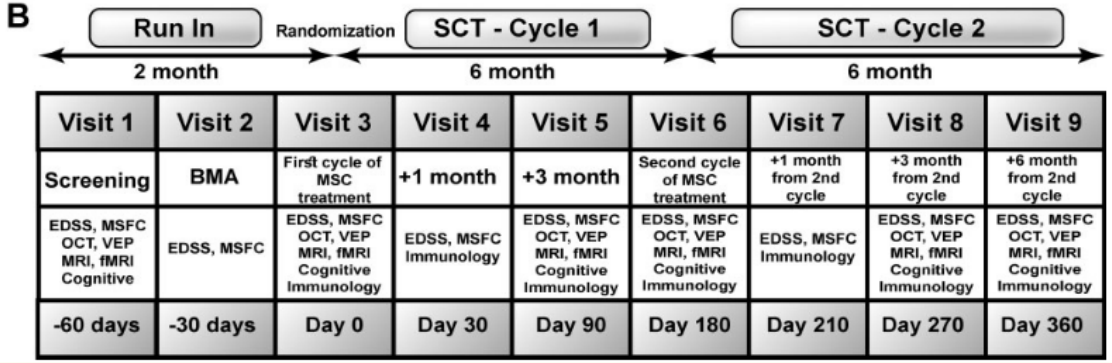


Cellules souches mesenchymateuses ???

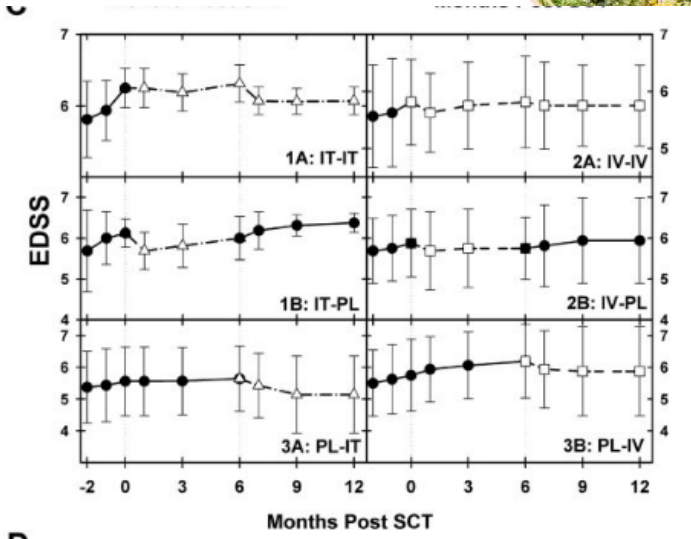


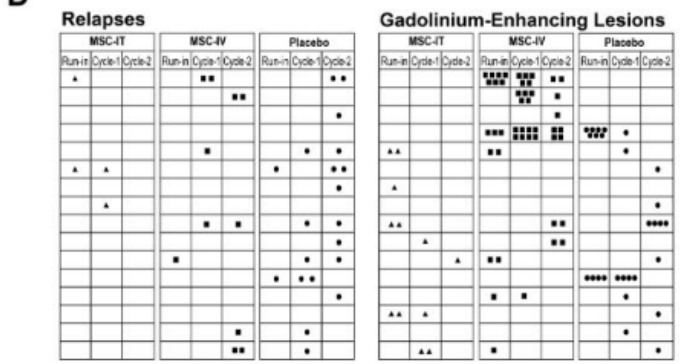
Cellules souches mesenchymateuses ???





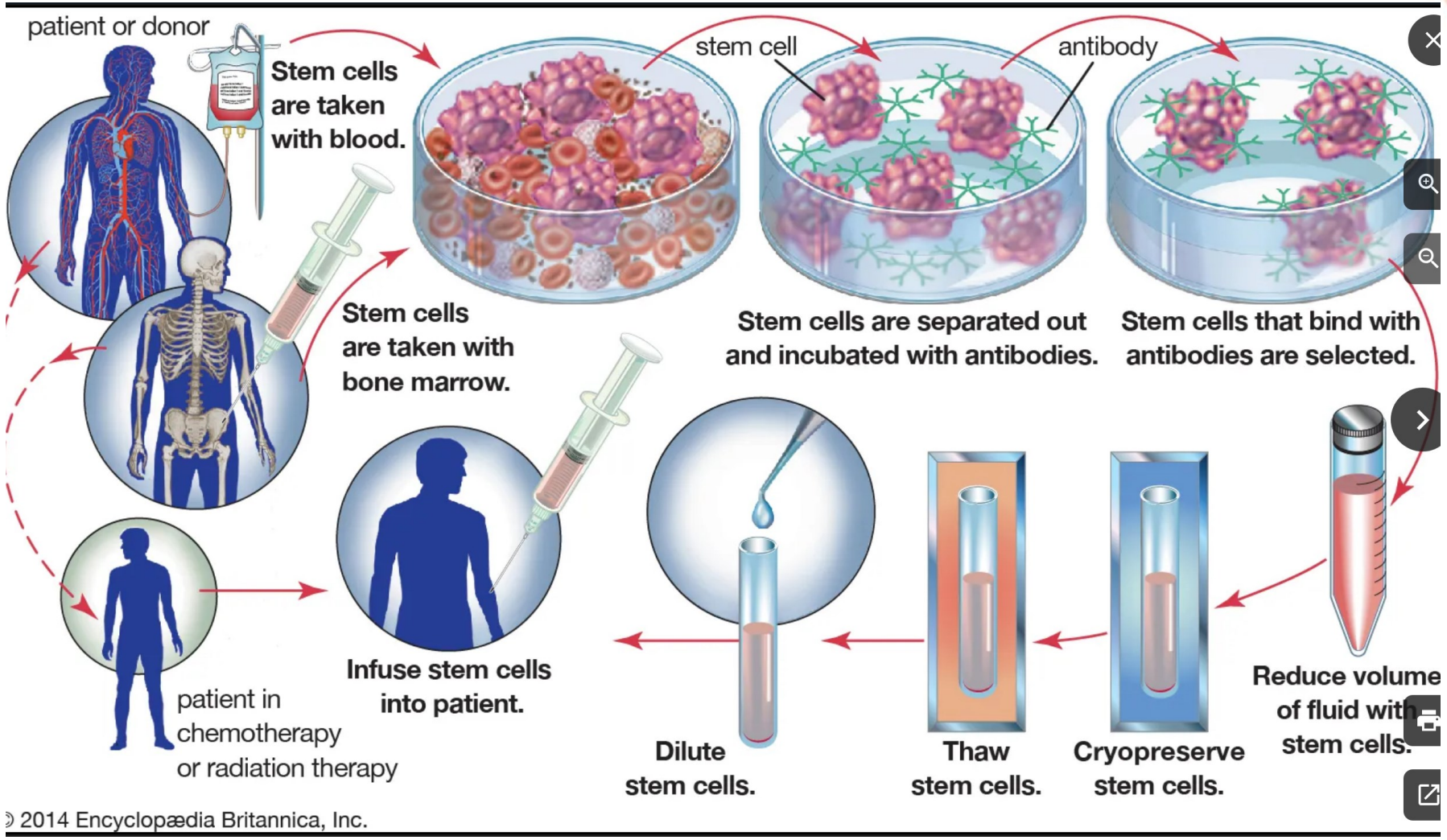
Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	Visit 7	Visit 8	Visit 9
Screening	BMA	First cycle of MSC treatment	+1 month	+3 month	Second cycle of MSC treatment	+1 month from 2nd cycle	+3 month from 2nd cycle	+6 month from 2nd cycle
EDSS, MSFC OCT, VEP MRI, fMRI Cognitive	EDSS, MSFC	EDSS, MSFC OCT, VEP MRI, fMRI Cognitive Immunology	EDSS, MSFC Immunology	EDSS, MSFC OCT, VEP MRI, fMRI Cognitive Immunology	EDSS, MSFC OCT, VEP MRI, fMRI Cognitive Immunology	EDSS, MSFC Immunology	EDSS, MSFC OCT, VEP MRI, fMRI Cognitive Immunology	EDSS, MSFC OCT, VEP MRI, fMRI Cognitive Immunology
-60 days	-30 days	Day 0	Day 30	Day 90	Day 180	Day 210	Day 270	Day 360



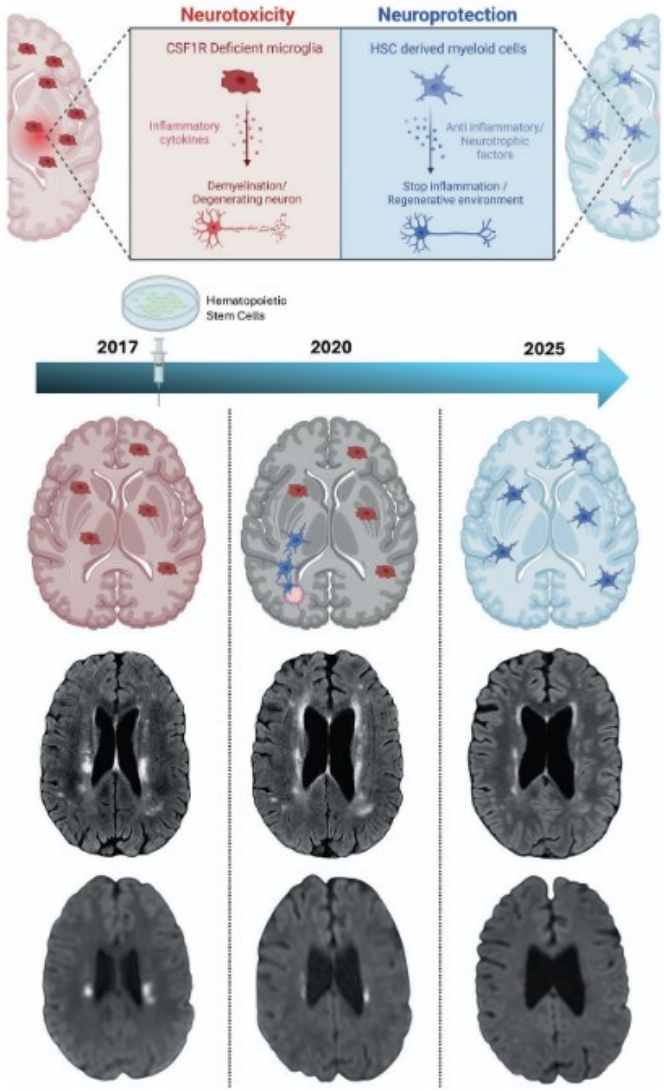


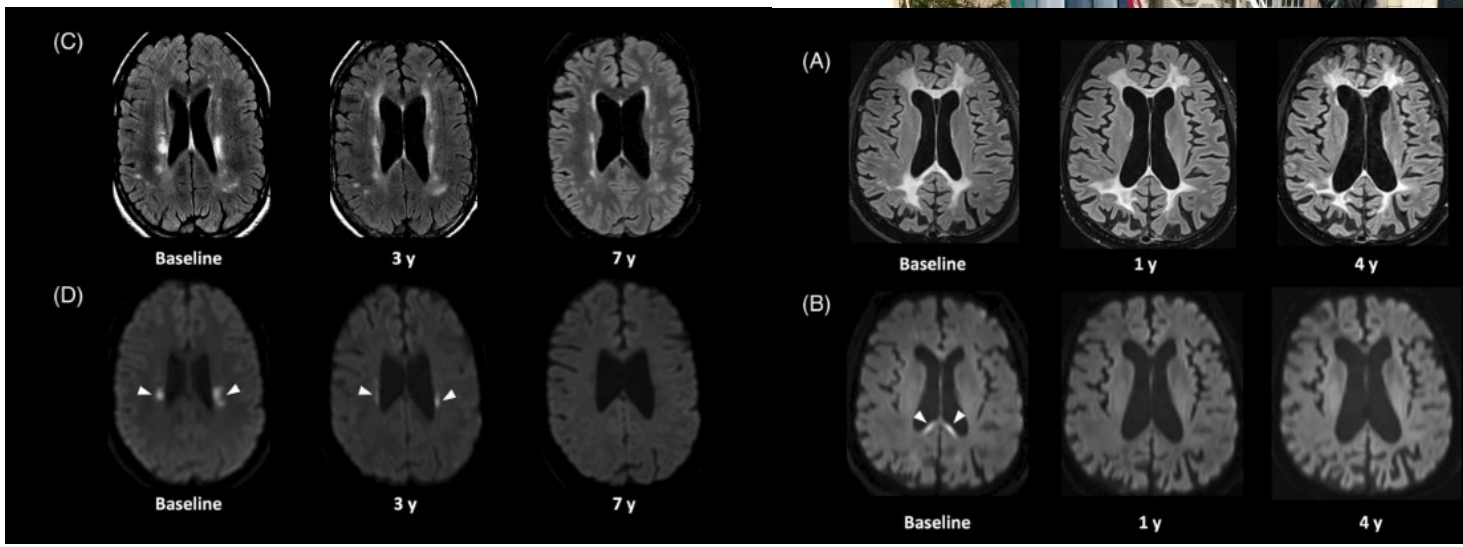
Shokati Sc reports 2025
Fernandez PLoS One 2018
Petrou Brain 2020

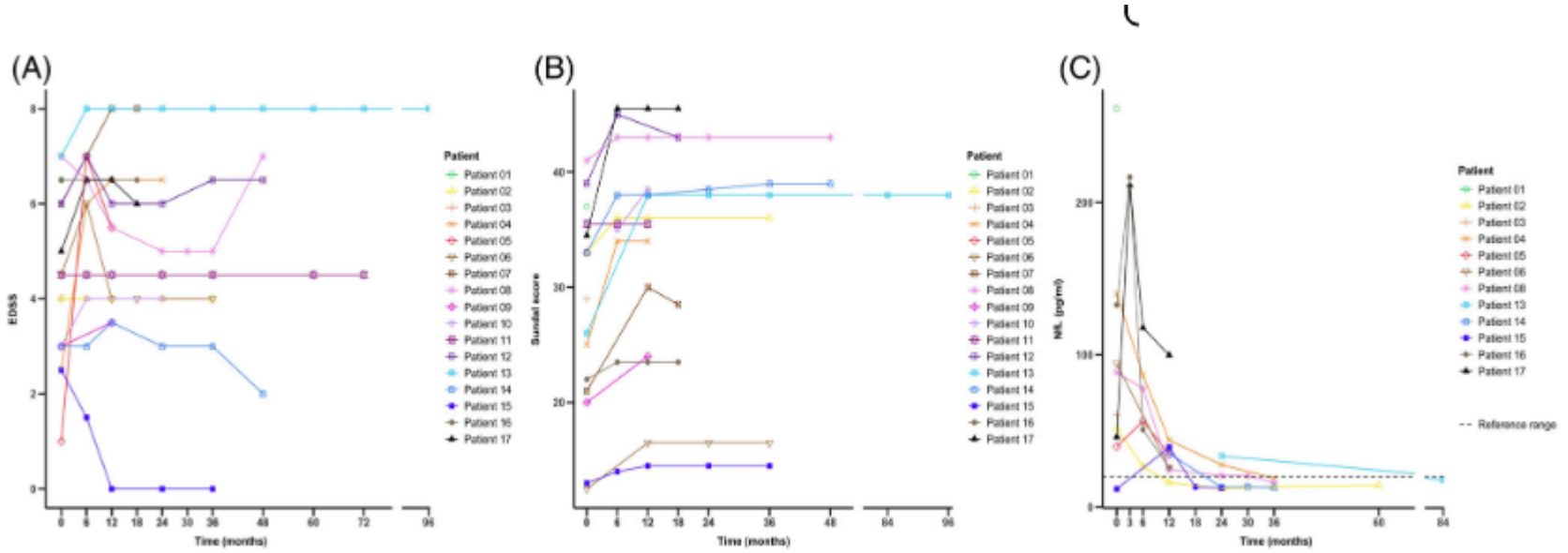
Principe des greffes de CSH



Allogreffes de CSH

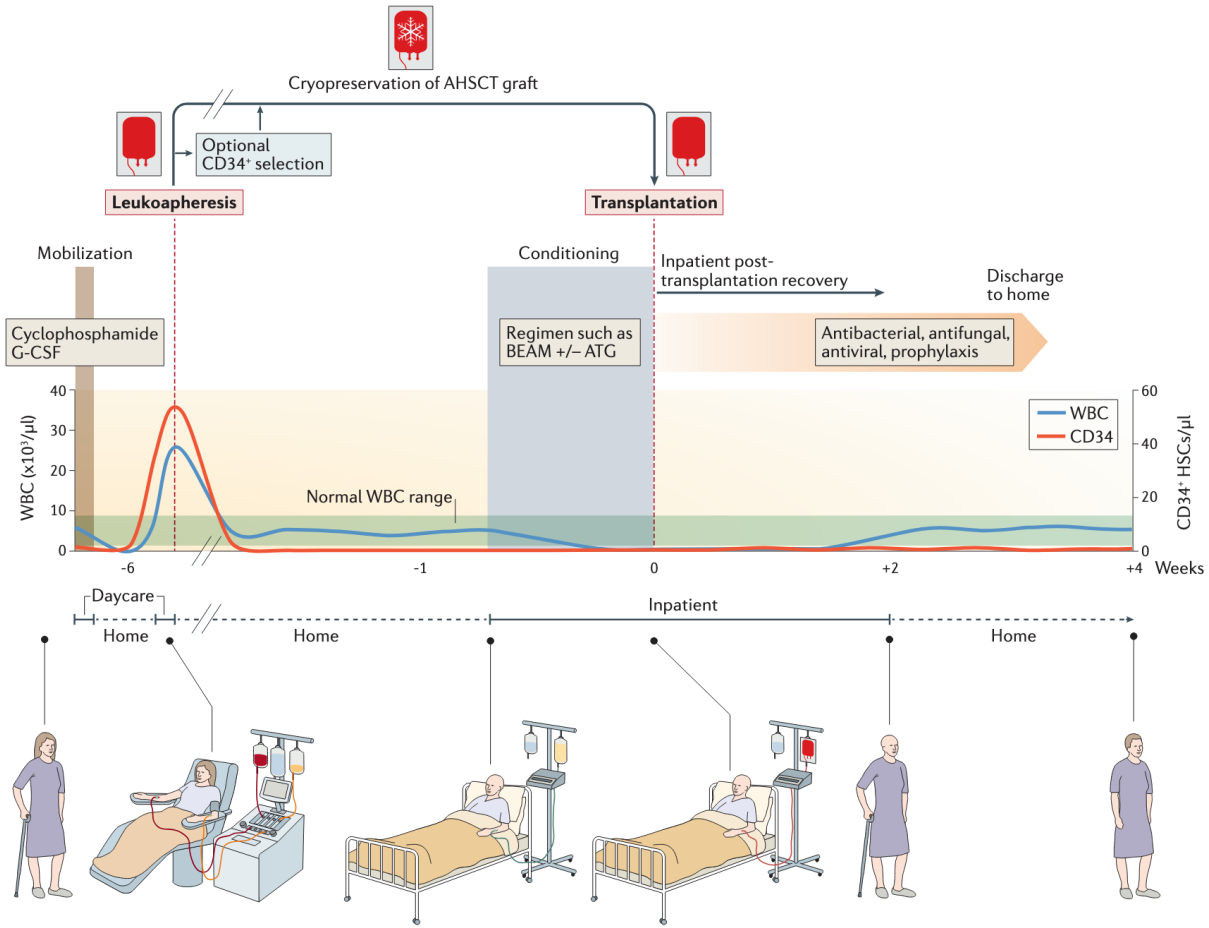


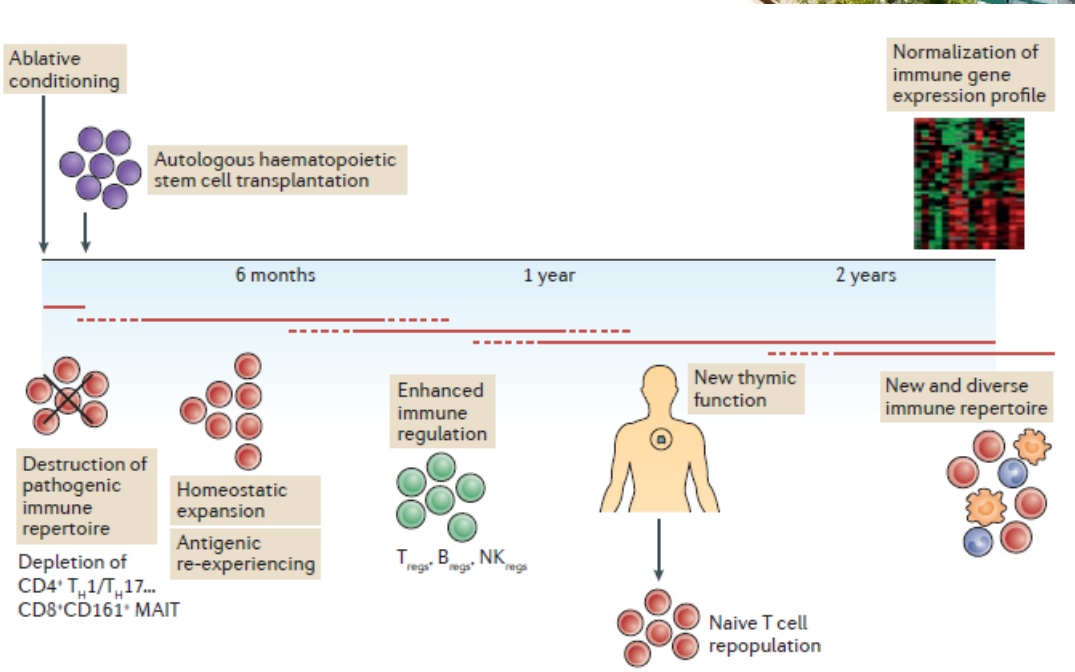




Yska et al., Movement disorders 2025

Principe des autogreffes de CSH





Muraro Nature Reviews Neurology 2017

Indications en neurologie: Sclérose en plaques

Research

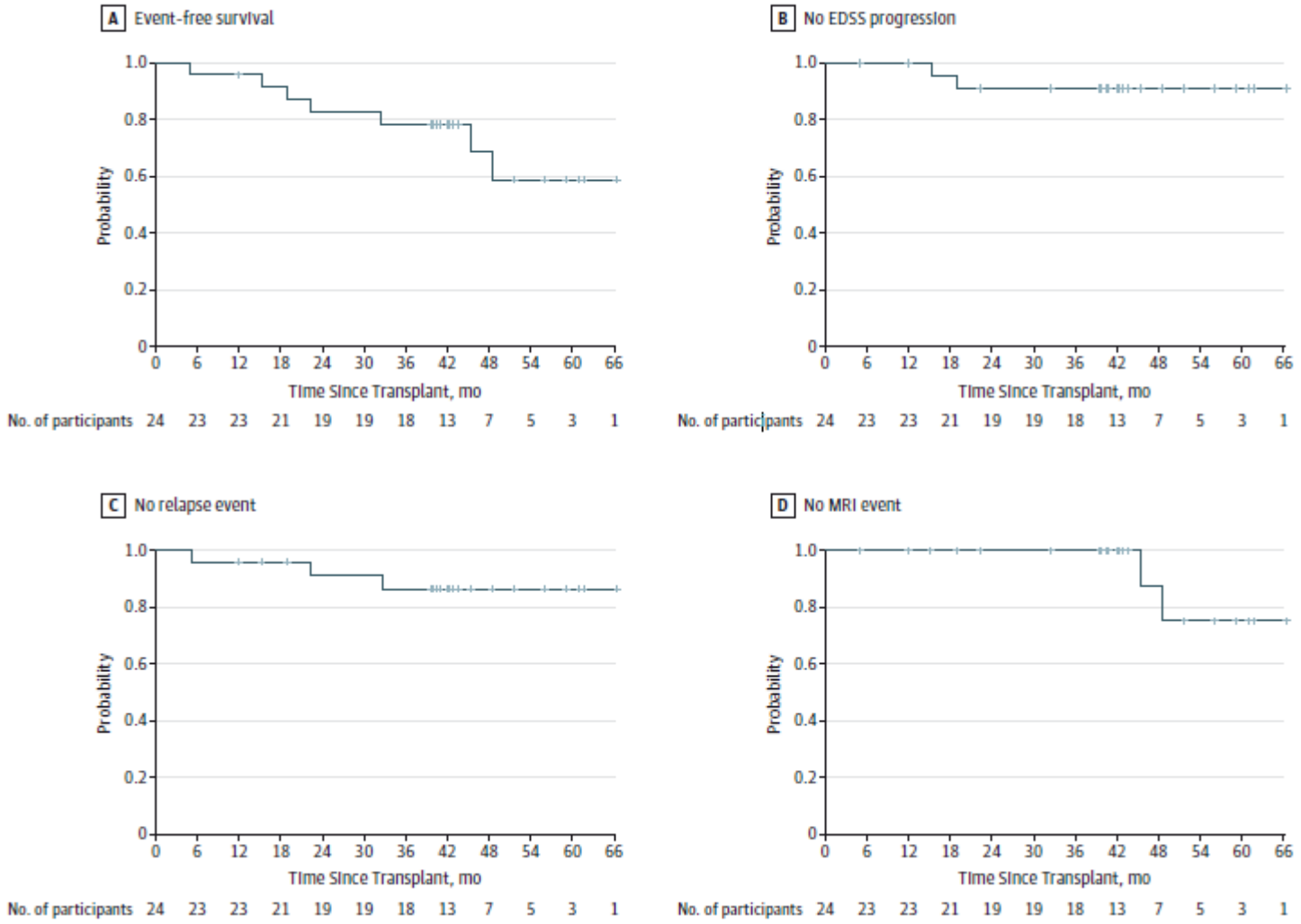
Original Investigation | CLINICAL TRIAL

High-Dose Immunosuppressive Therapy and Autologous Hematopoietic Cell Transplantation for Relapsing-Remitting Multiple Sclerosis (HALT-MS)

A 3-Year Interim Report

Richard A. Nash, MD; George J. Hutton, MD; Michael K. Racke, MD; Uday Popat, MD; Steven M. Devine, MD; Linda M. Griffith, MD, PhD; Paolo A. Muraro, MD, PhD; Harry Openshaw, MD; Peter H. Sayre, MD, PhD; Olaf Stüve, MD, PhD; Douglas L. Arnold, MD; Meagan E. Spychala, DrPH; Kaitlyn C. McConville, MS; Kristina M. Harris, PhD; Deborah Phippard, PhD; George E. Georges, MD; Annette Wundes, MD; George H. Kraft, MD, MS; James D. Bowen, MD

Figure 1. Neurologic Outcomes: Composite Primary End Point and Components



Nash JAMA Neurol 2015

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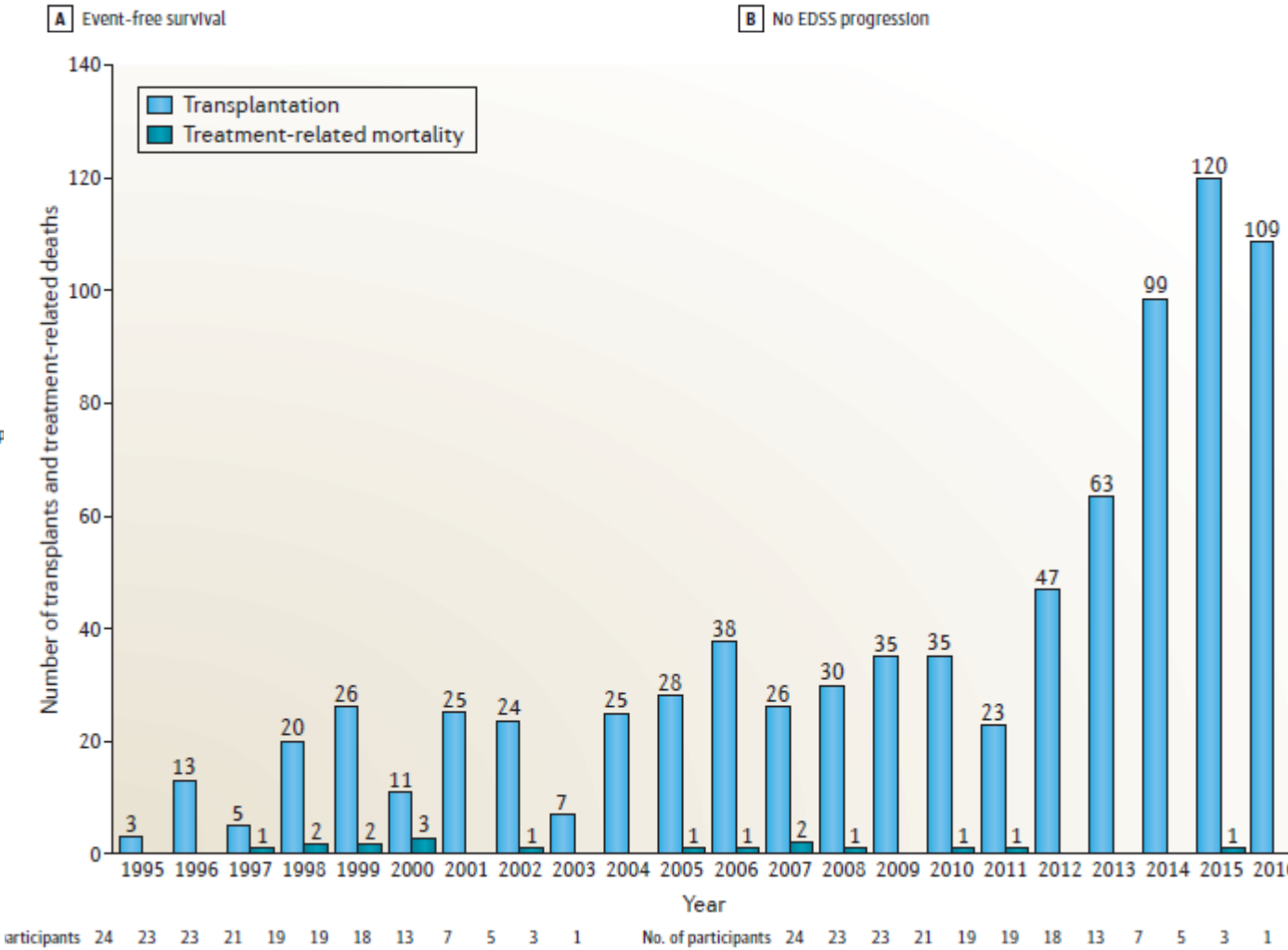
No. of p

Table 3 | **Study design and outcomes in recent clinical studies of AHSCT for MS**

Study	Patient sample size	Median follow-up (months)	Regimen type	Patients with disability progression at 2 years (%)	Patients with disability progression at 5 years (%)	Refs
Burman *et al.*, 2014	41	47.4	Intermediate	10	23	10
Burt *et al.*, 2015	145	24.0	Low	7	13	11
Mancardi *et al.*, 2015	9	48.0	Intermediate	33	Not reported	12
Currò *et al.*, 2015	7	60.0	Low	14	43	56
Muraro *et al.*, 2017	281	79.2	Mixed	16	54	55
Shevchenko *et al.*, 2015	99	48.9	Intermediate	1	13	71
Atkins *et al.*, 2016	24	80.4	Intermediate	30	30	13
Nash *et al.*, 2017	25	62.0	Intermediate	10	14	14

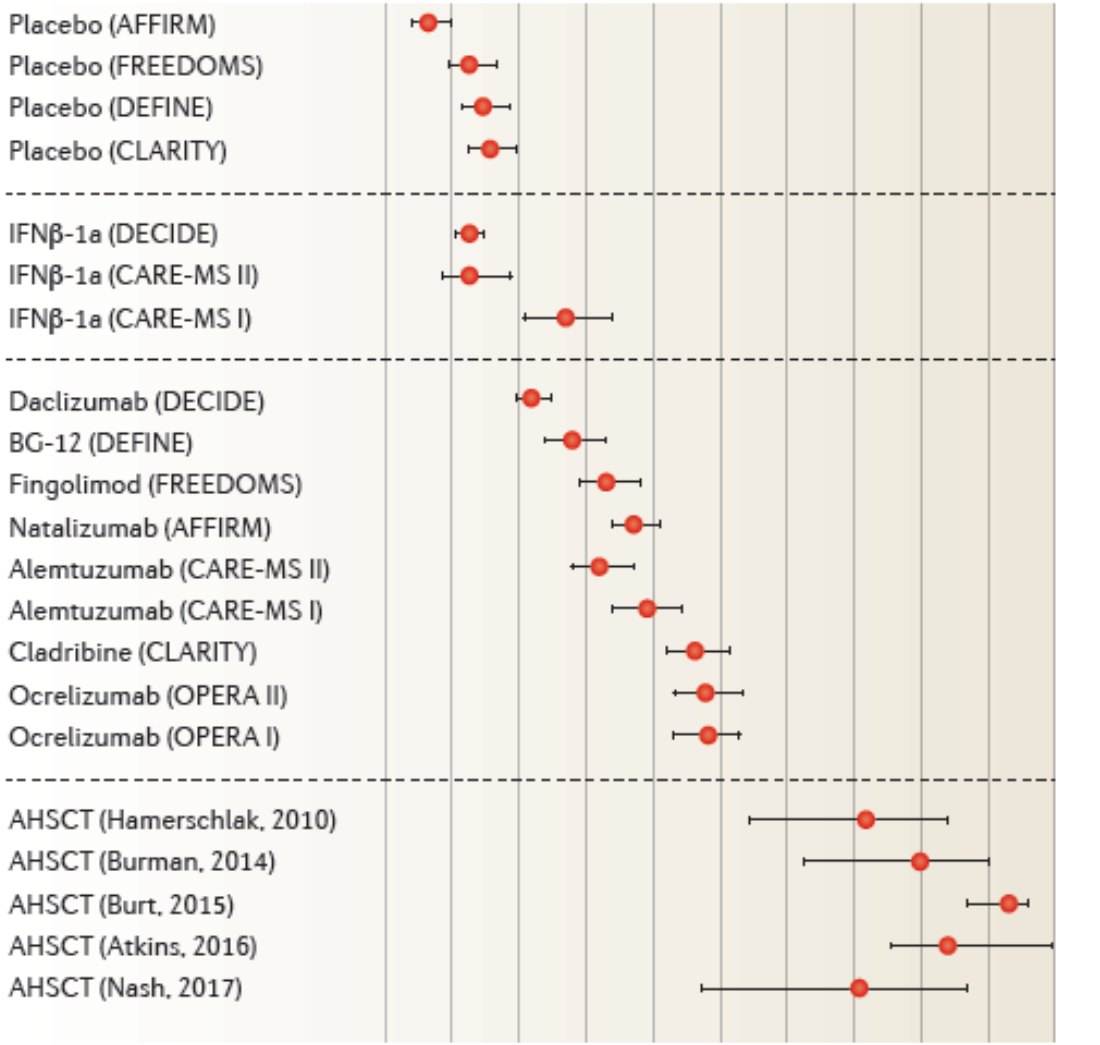
Papers included are those that reported sufficient information about most variables we considered. AHSCT, autologous haematopoietic stem cell transplantation; MS, multiple sclerosis.

Figure 1. Neurologic Outcomes: Composite Primary End Point and Components



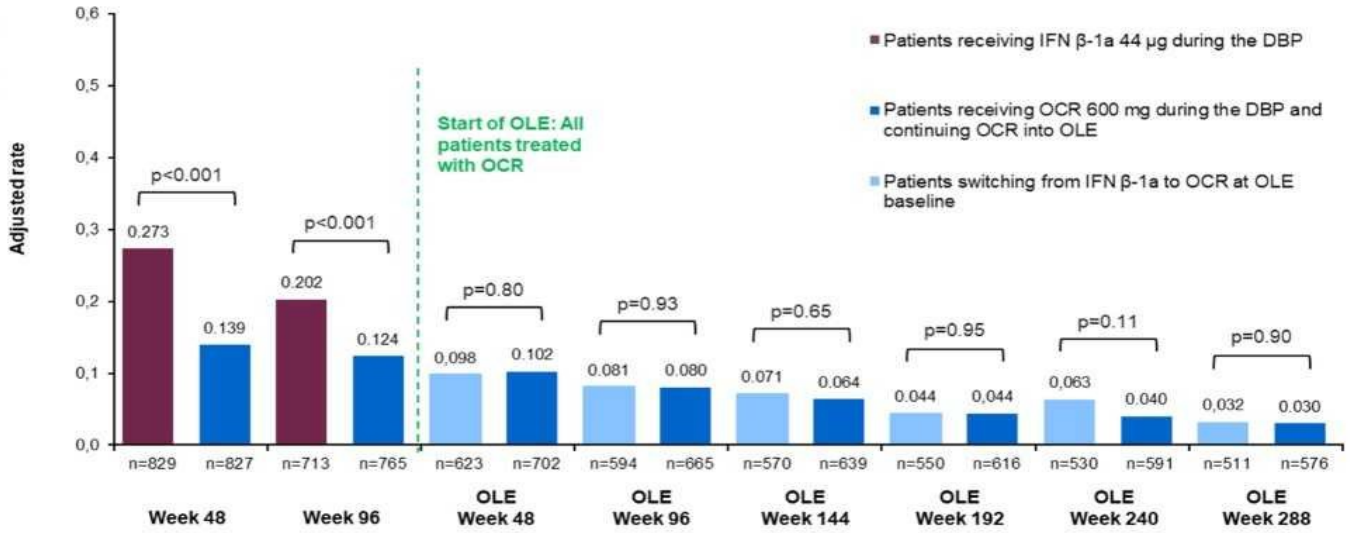
Muraro Nature Reviews Neurology 2017

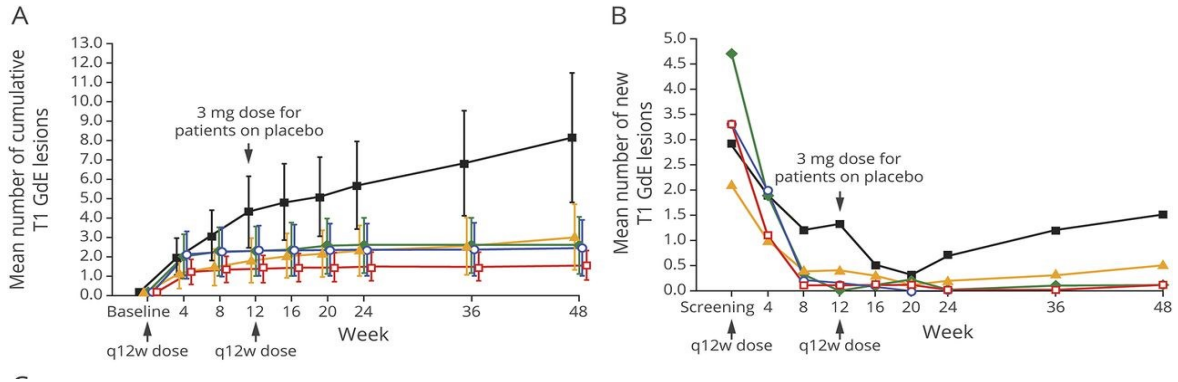
Indications en neurologie: Sclérose en plaques

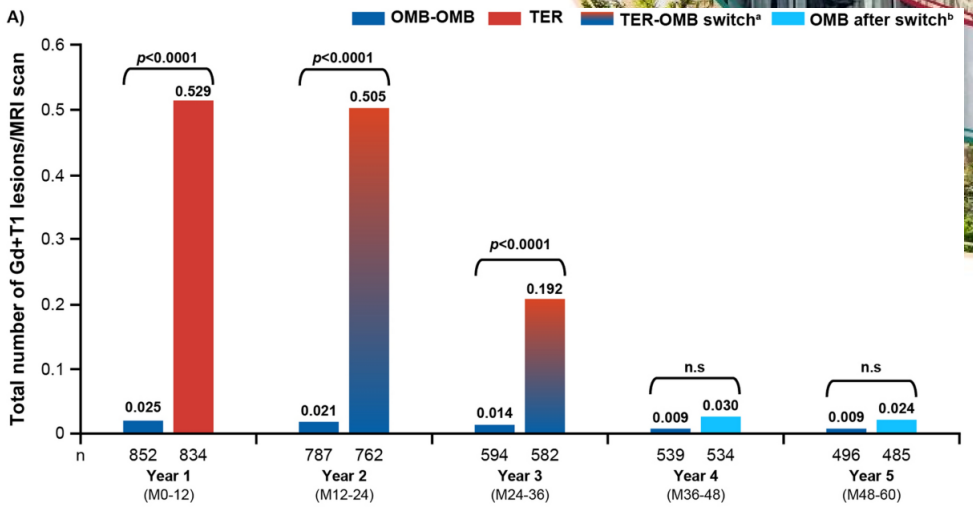


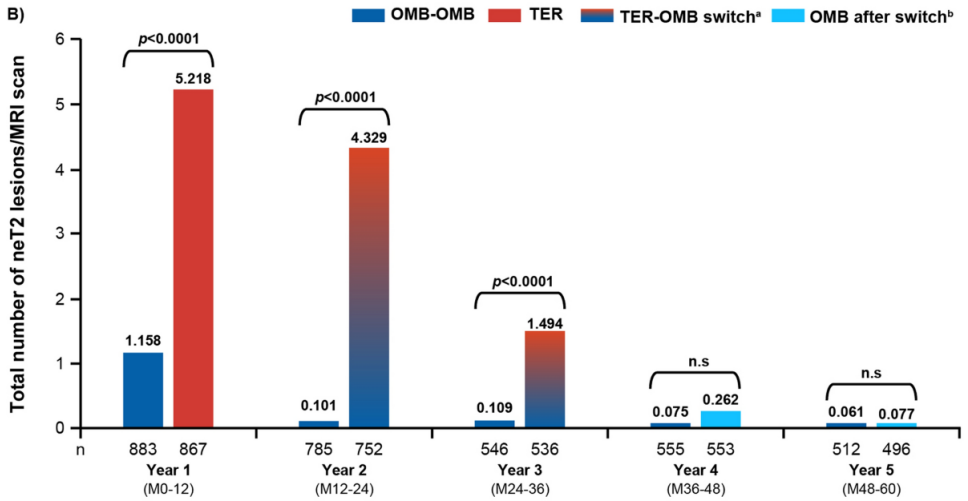
Muraro Nature Reviews Neurology 2017

Indications en SEP: limites



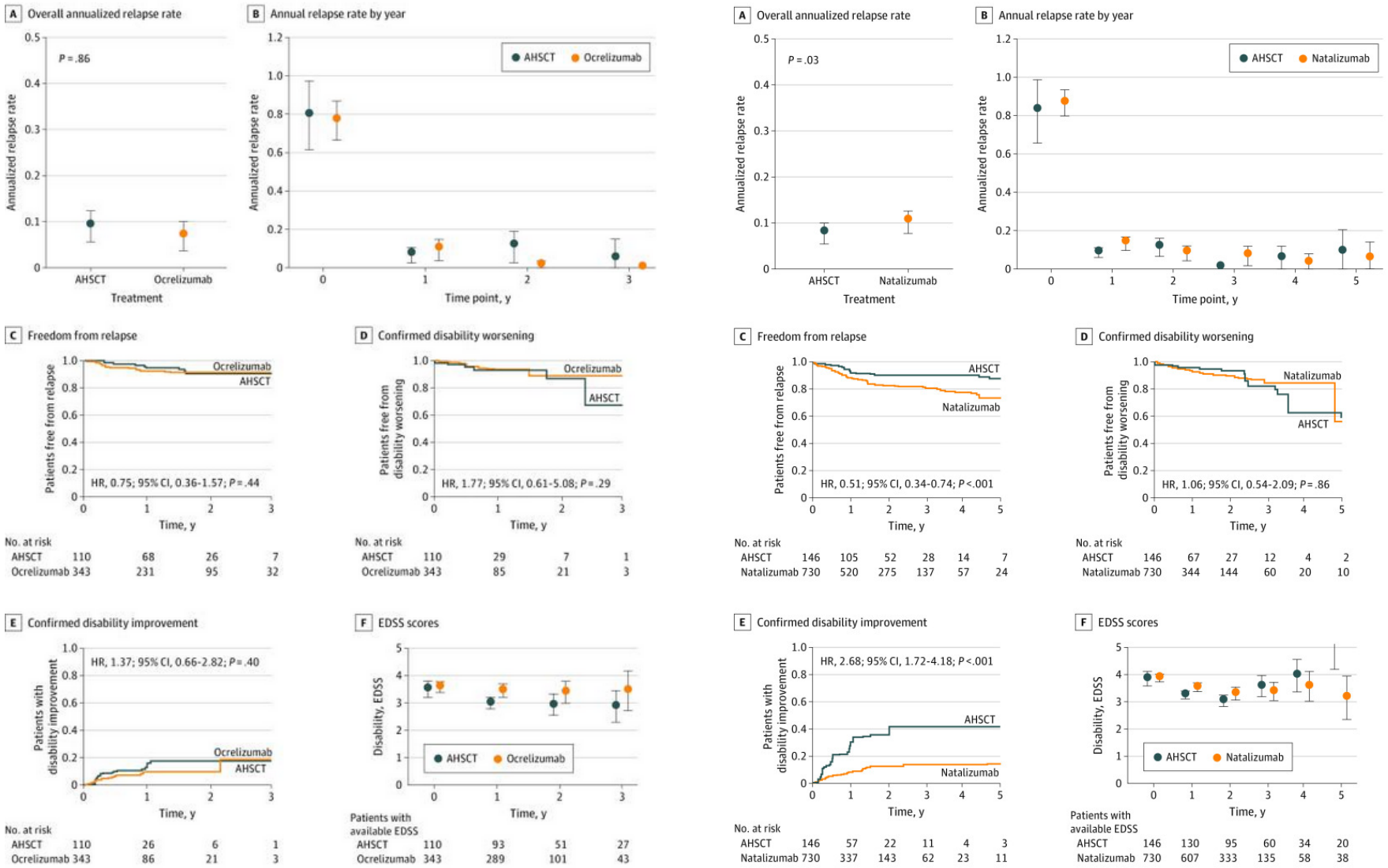






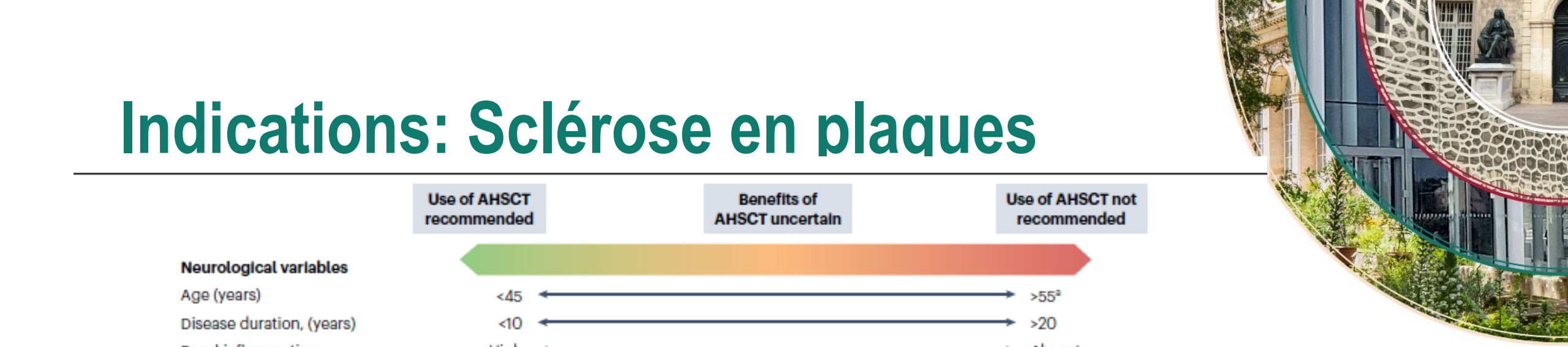
Hauser Neurology 2020; Hauser 2025

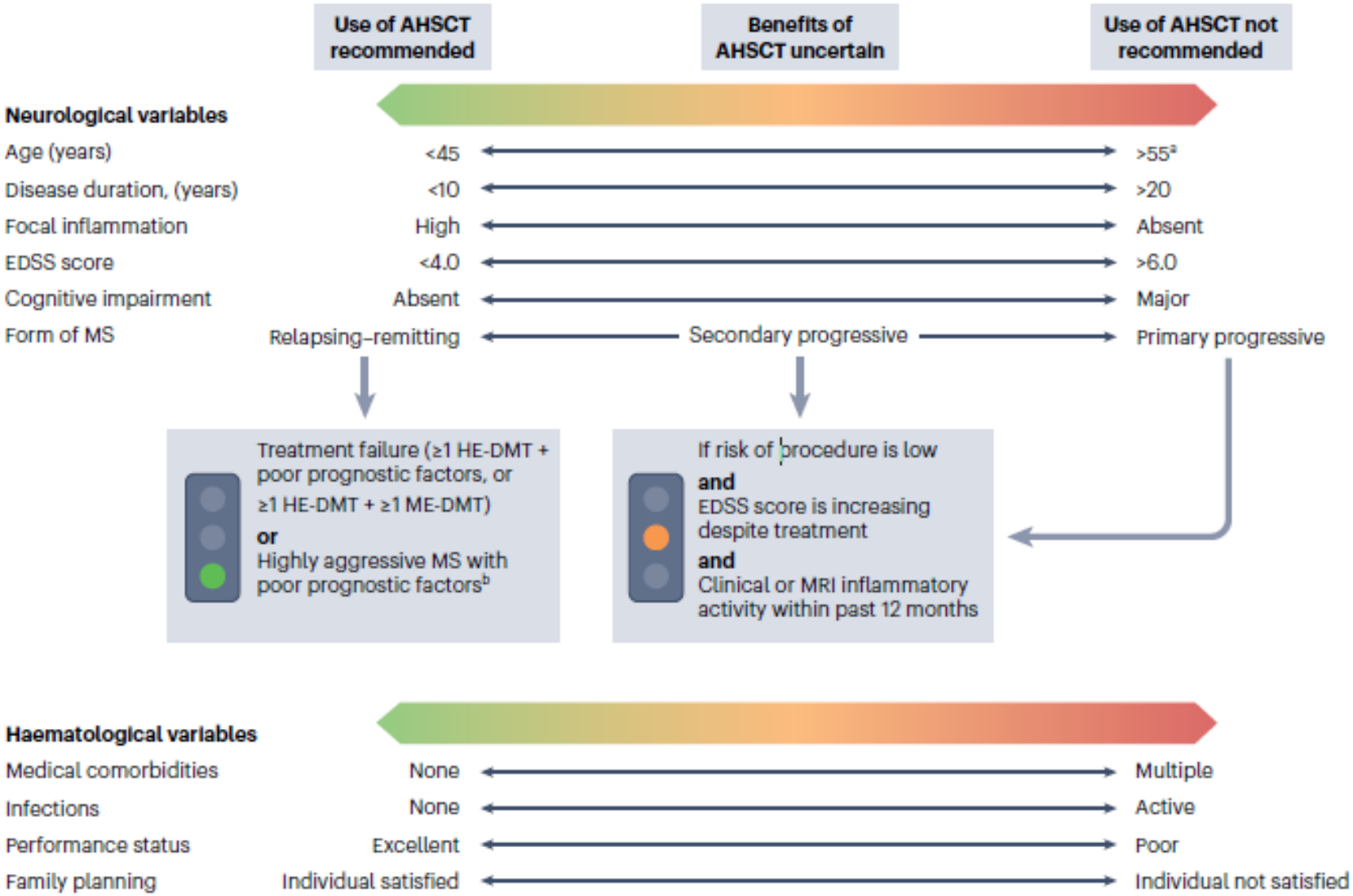
Indications en SEP: limites



Kalincik JAMA Neurol 2023

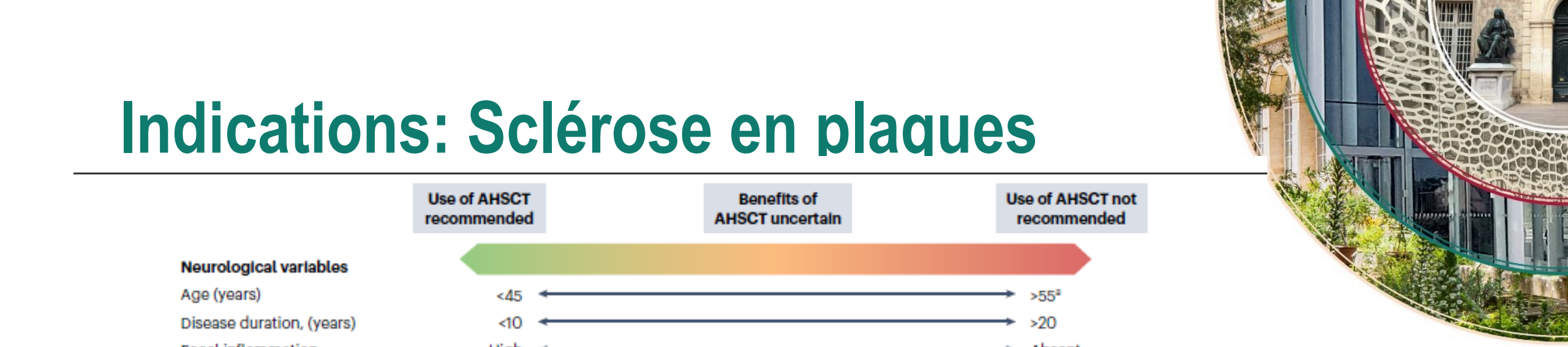
Indications: Sclérose en plaques

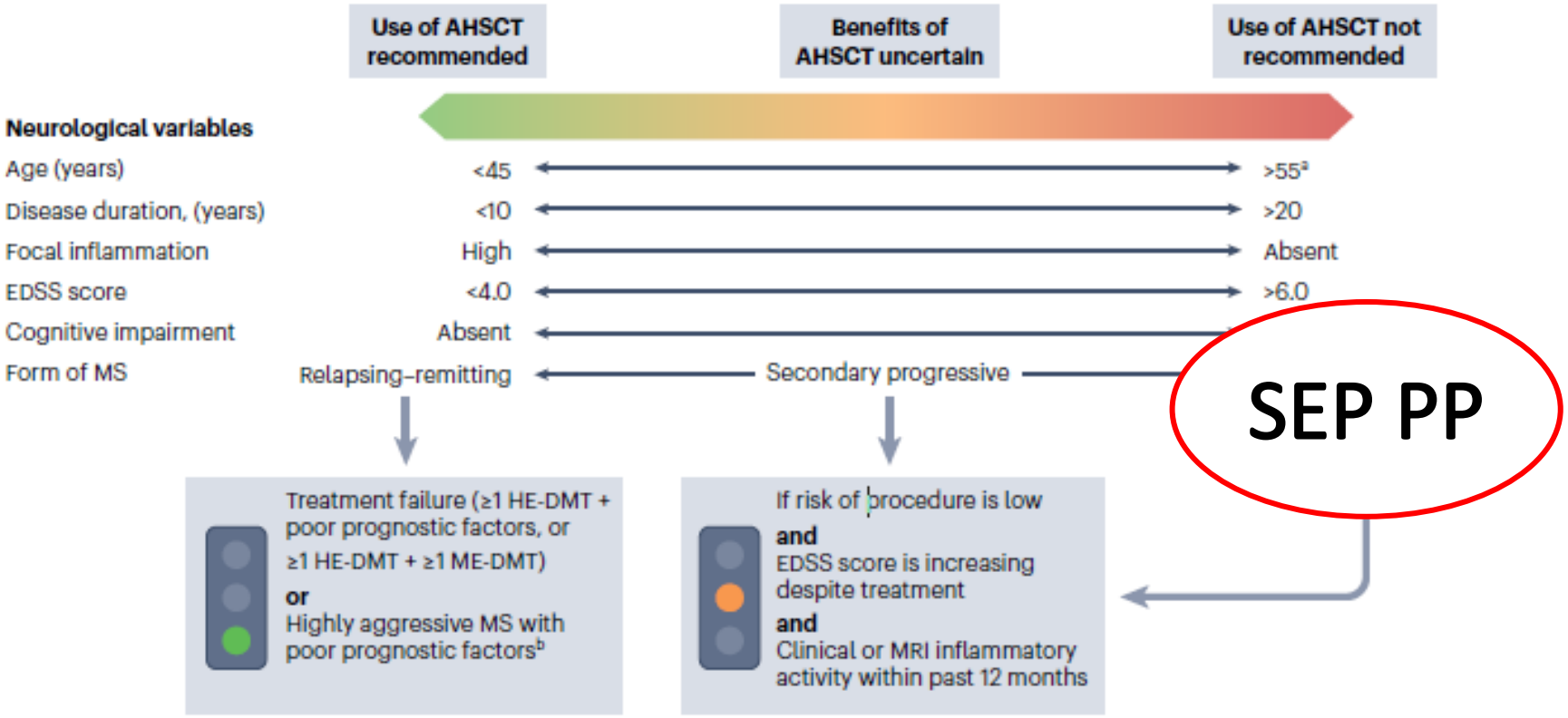




Muraro NRN 2025

Indications: Sclérose en plaques



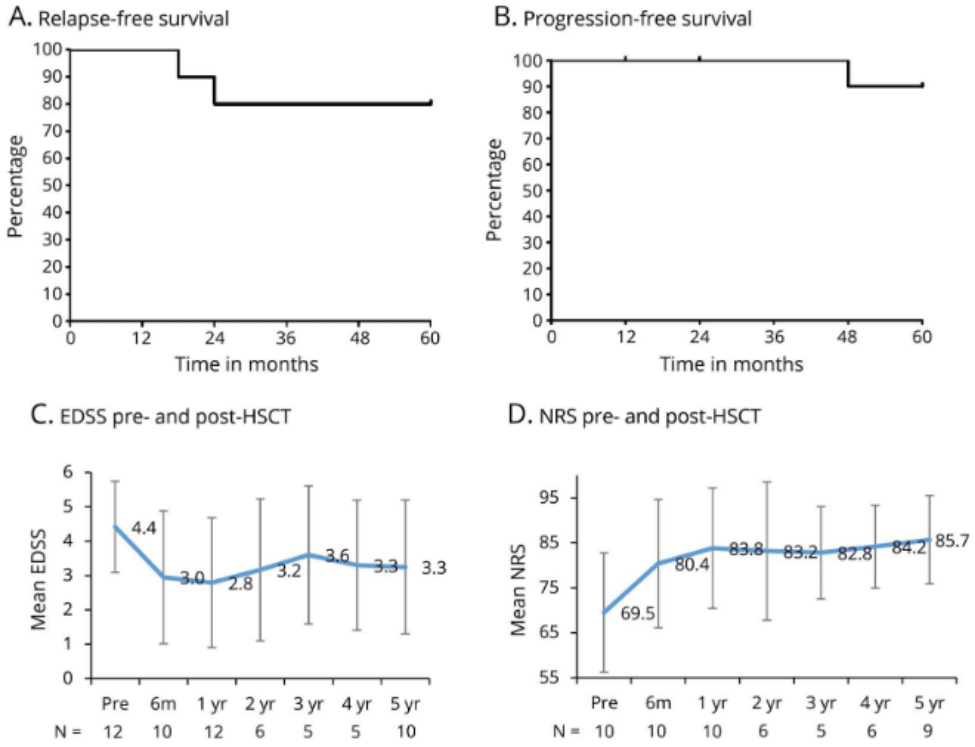


SEP PP

Muraro NRN 2025

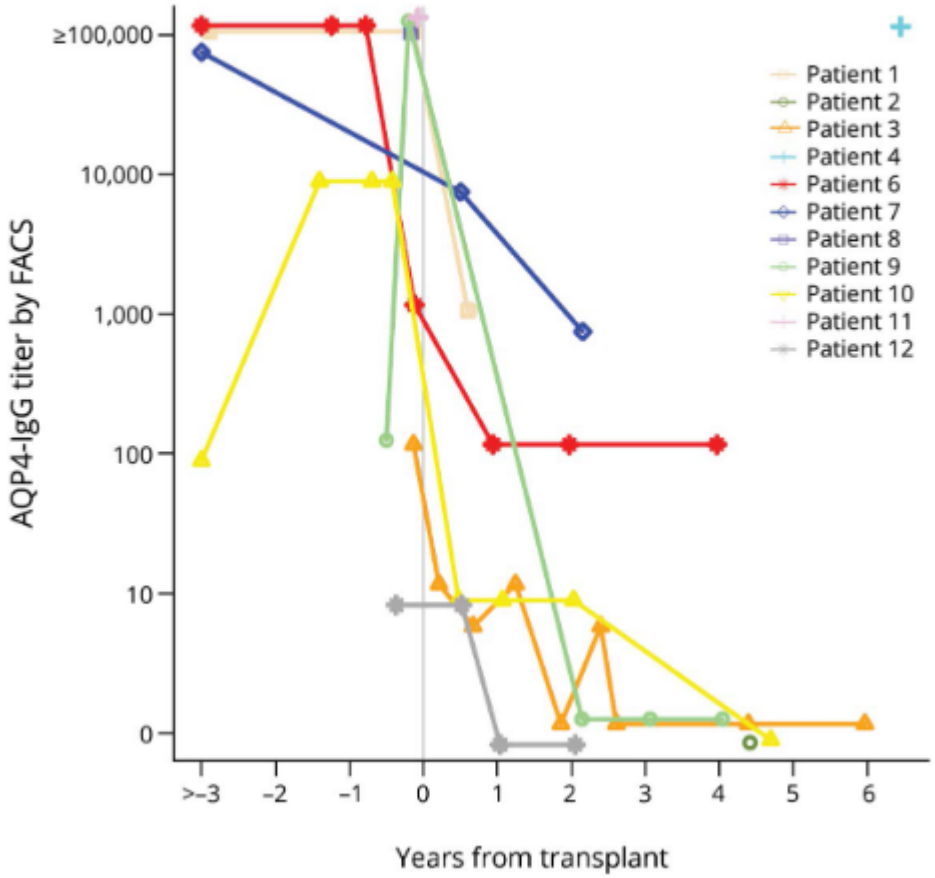
Autres indications??? NMOSD

Figure 1 Neurologic outcome after hematopoietic stem cell transplantation (HSCT) for neuromyelitis optica spectrum disorder



(A–D) EDSS = Expanded Disability Status Scale (range 0–10 in 0.5 increments from none [0] to worst [10] neurologic disability). NRS = neurologic rating scale (range 0 [worse]–100 [best] in 1-point increments).

Figure 3 Aquaporin-4 (AQP4) titer by AQP4 flow cytometry assay (fluore
hematopoietic stem cell transplantation (HSCT) from stored s



Burt Neurology 2019

Autres indications??? PIDC

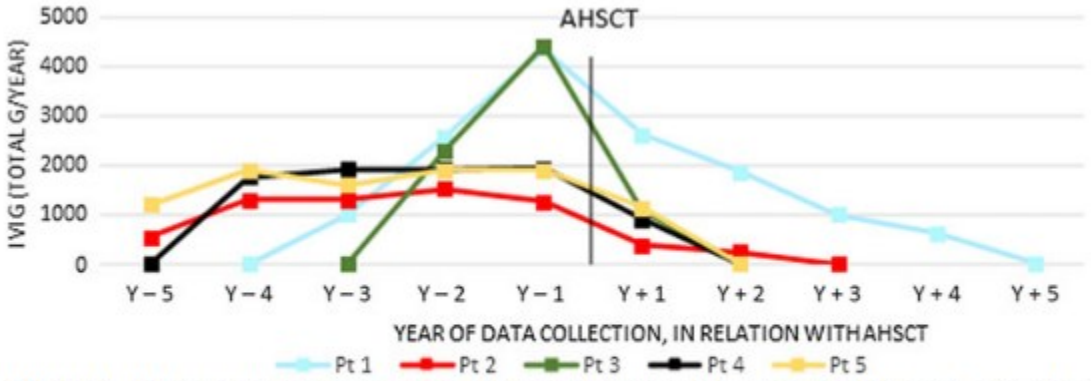


Figure 1. *IVIG requirements are expressed in total g/year (y axis) for the years preceding (Y − 1, Y − 2 . . .) and following (Y + 1, Y + 2) autologous hematopoietic stem cell transplantation (AHSCT).*

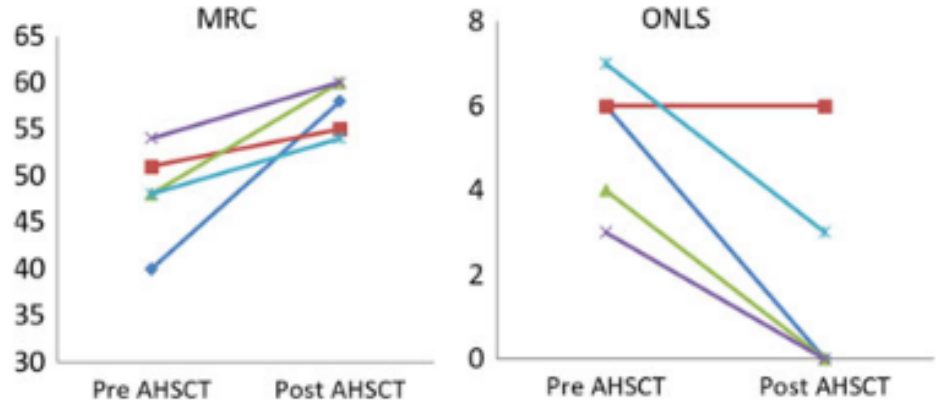


Figure 2. *A greater MRC sum score or lower ONLS correlate with improved clinical status.*
Abbreviations: AHSCT, autologous hematopoietic stem cell transplantation; MRC, medical research council; ONLS, Overall Neuropathy Limitations Scale.

Masson-Roy Can J Neurol Sci 2021

Autres indications???

- Myasthénie

- Stiff Person syndrome

MG Stem Cell Transplant

B. Beland *et a*

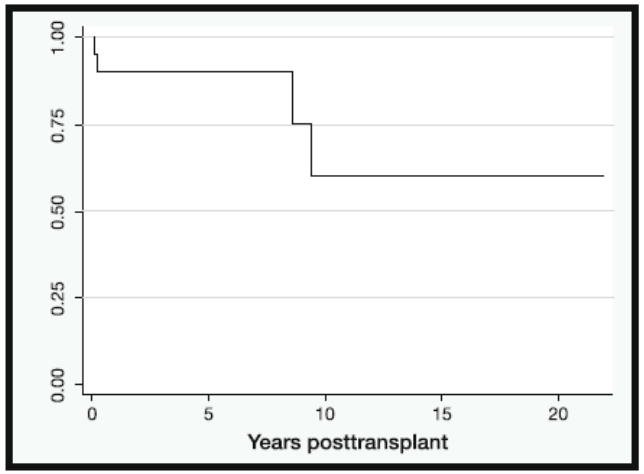
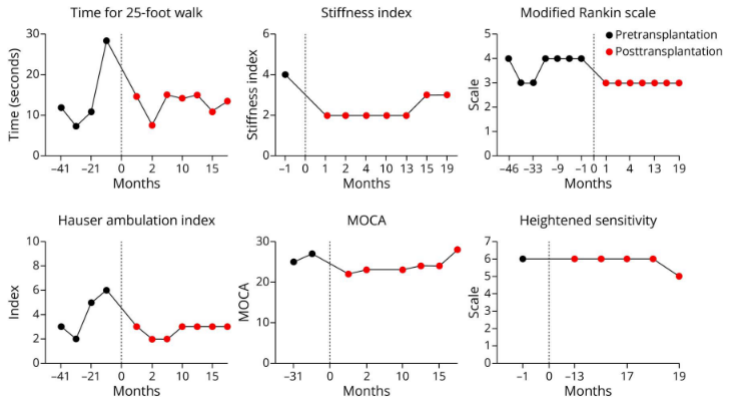


Figure 1. Kaplan–Meier curves showing overall survival.

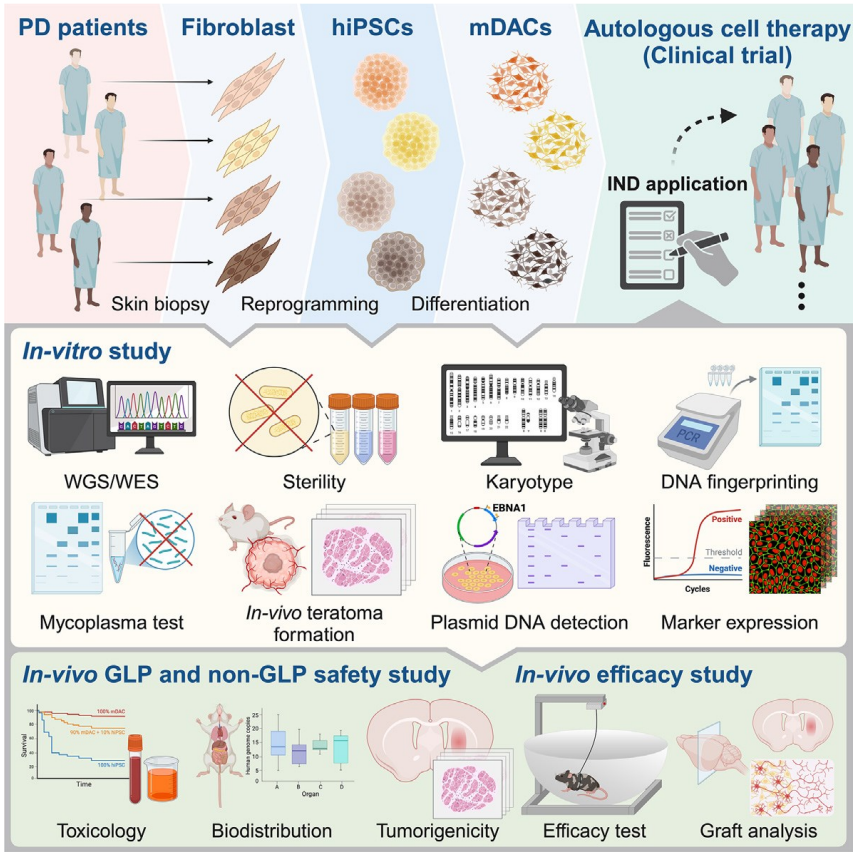
Figure Clinical Scales Preautologous and Postautologous Hematopoietic Stem Cell Transplant

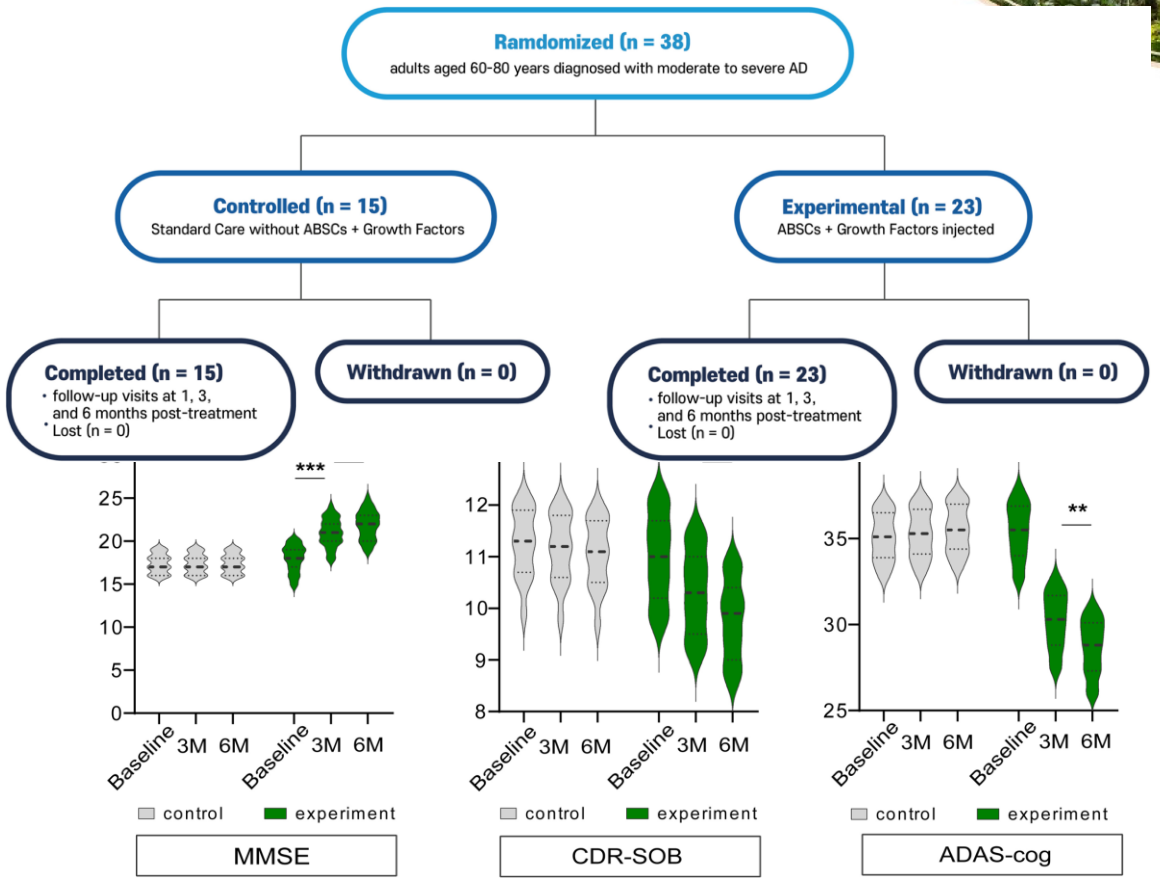


Beland et al ACTN 2024; Celli NNNi 2024

Et après?

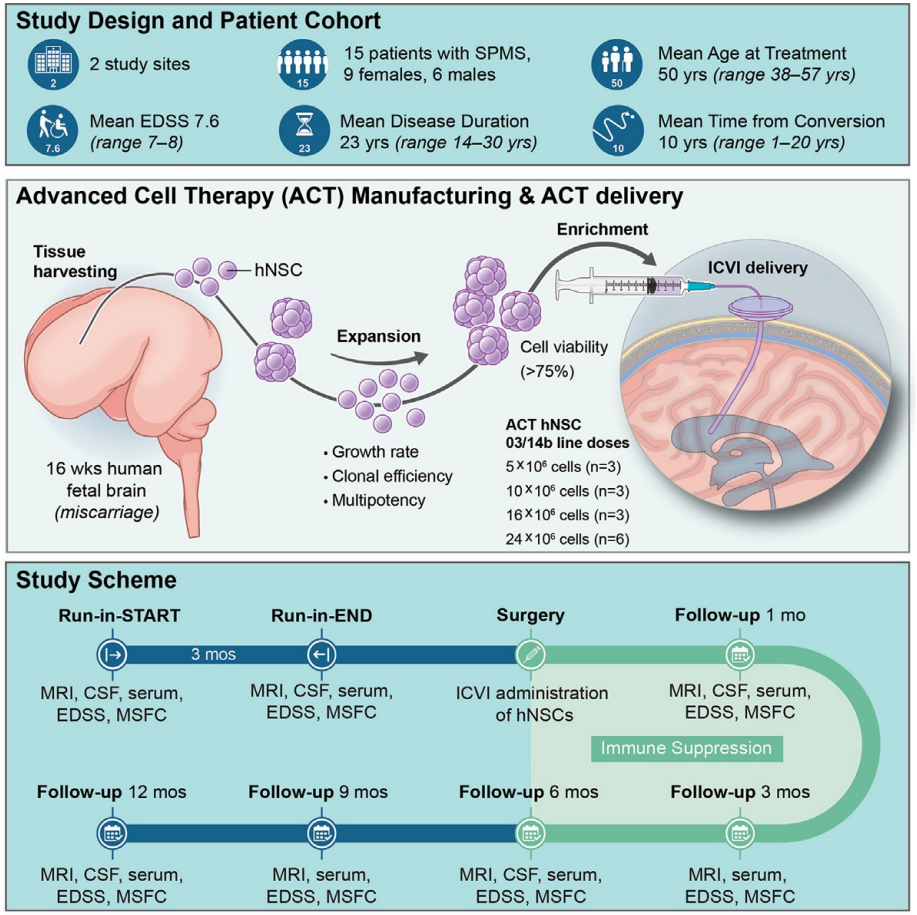
- **Place des AHSCT dans les maladies neurodégénératives?**

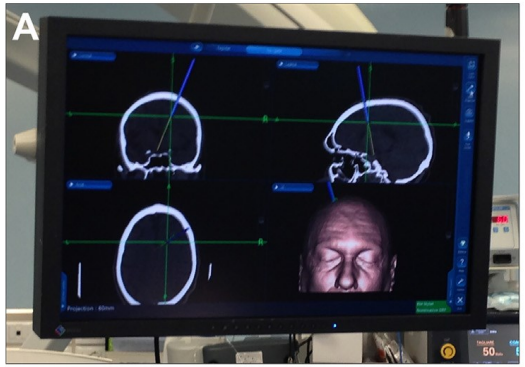


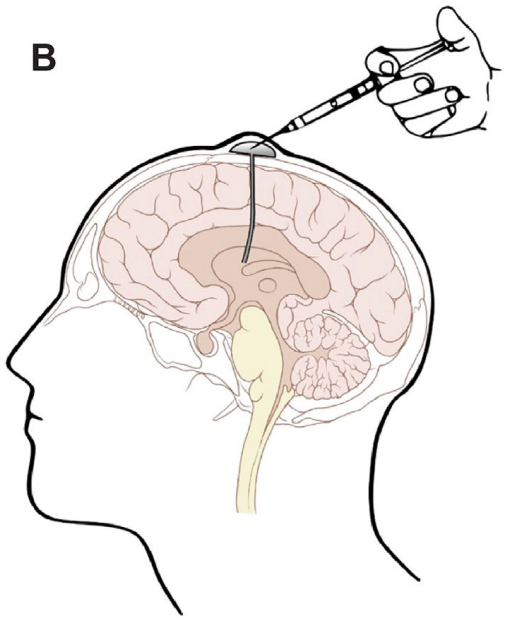


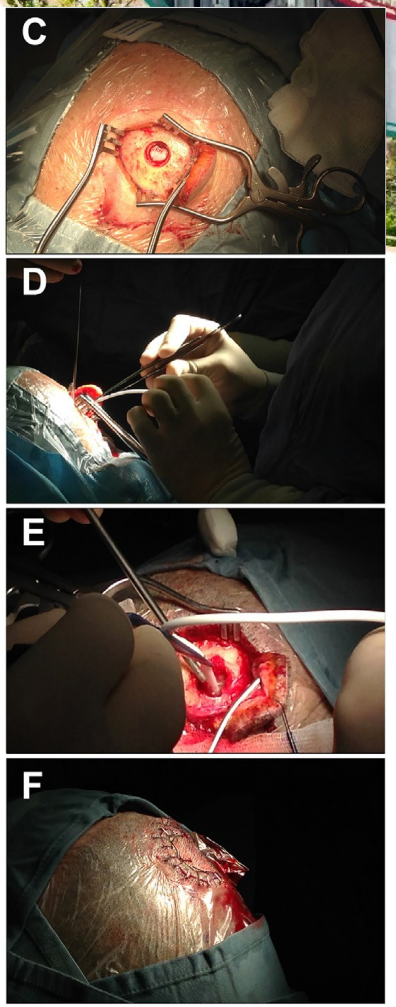
Jin Lee Molecular Neurobiology 2026; Jeon Cell Stem Cell 2025

Et après? Allogenic neural stem cells









10 patients traités

➔ Stabilité clinique & bonne tolérance

Leone Cell Stem cell 2023

Et après? Mesenchymal stem cells

Recruiting

Allogenic Adipose Tissue-derived Mesenchymal Stromal Cells for the Treatment of Primary Progressive Multiple Sclerosis (MAESTRO-4MS)

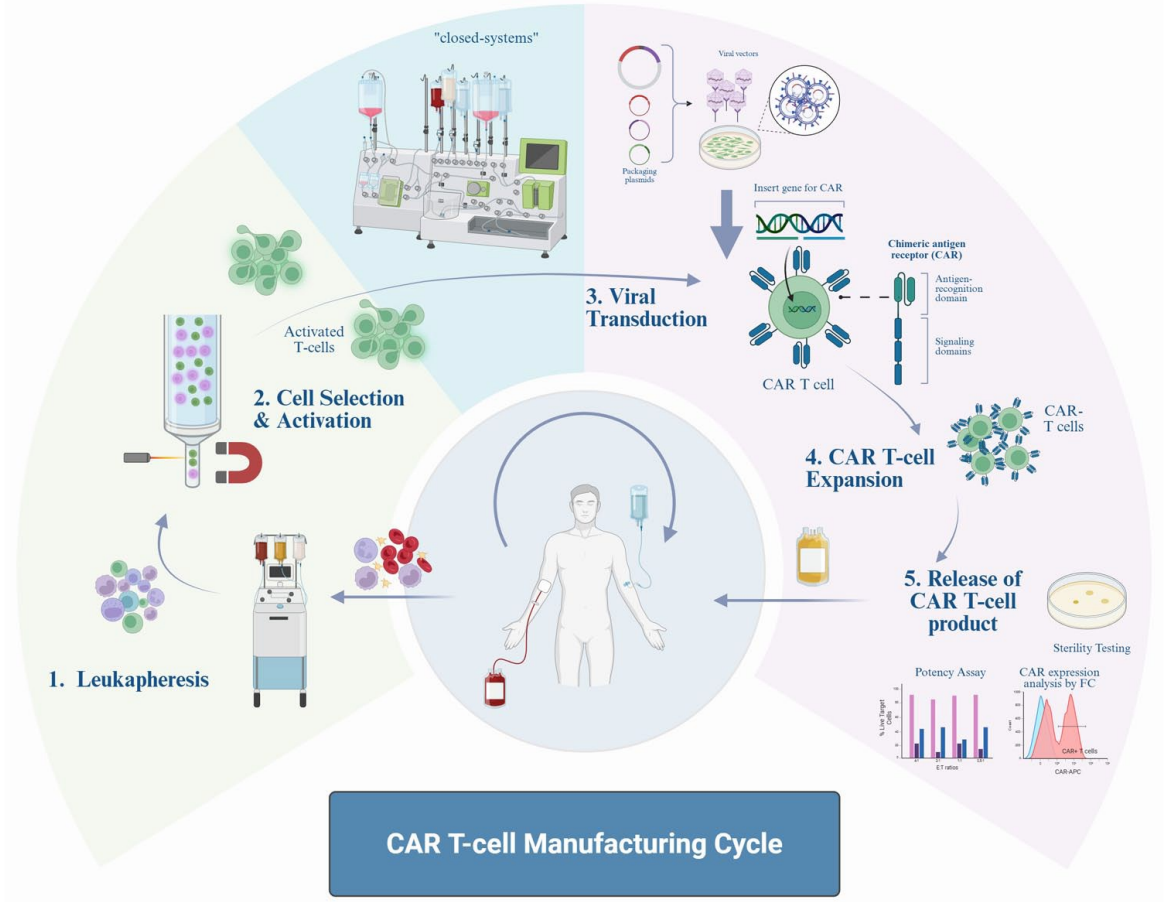
ClinicalTrials.gov ID NCT06592703

Sponsor Rennes University Hospital

Information provided by Rennes University Hospital (Responsible Party)

Last Update Posted 2026-01-05

Et après? CAR T-cells



CAR T cells in	Autoimmunity	Hemato-Oncology
translational stage	none approved (off-label or clinical trials)	approved
primary target antigens	CD19, CD20, BCMA, autoantigen-specific BCRs	CD19, CD20, CD22, BCMA, GPRC5D
mode of action	immune reset by transient, deep depletion of B cell compartment	permanent elimination of malignant cells
CAR T cell persistence	no impact on efficacy	positive correlation with efficacy
B cell aplasia	typically 3 - 6 months	often >12 months, in some cases multiple years
toxicity risk (e.g., CRS, ICANS, infections)	low incidence and severity	moderate to high risk, overall TRM ca. 4-5 %
therapeutic goal	drug free remission, immune reset	long term remission, cure

Katsaros et al Ther Adv Neurol Dis 2025

Et après? CAR T-cells ➔ lymphomes SNC

RESEARCH ARTICLE

Neurotoxicity in Patients With CNS Lymphomas Treated With CAR T-Cell Therapy

A Study From the French Oculo-Cerebral Lymphoma Network

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- ↗ Pseudoprogression
- ↗ Neurotoxicité
- ↘ Réponse clinique

Response to CAR T cells at 3 mo (%)	
Complete response	22 (46)
Partial response	12 (25)
Progressive disease	14 (29)
12-mo PFS, median (95% CI)	43 (30–63)
12-month OS, median (95% CI)	60 (46–80)
CRS (%)	40 (83)
Grade 1	17 (35)
Grade 2	22 (46)
Grade 3	1 (2)
Grade 4	0
Delay between CAR T-cell infusion and onset of CRS, median (range) (d)	1 (0–6)
Duration of CRS, median (range) (d)	4 (1–10)
Treatment of CRS (%)	
Tocilizumab	34 (71)
Steroids	14 (29)
Neurotoxicity	
ICANS (%)	
No ICANS	17 (35)
Nongraded ICANS[a]	5 (10)
Grade 1	11 (23)
Grade 2	4 (8)
Grade 3	7 (15)
Grade 4	4 (8)

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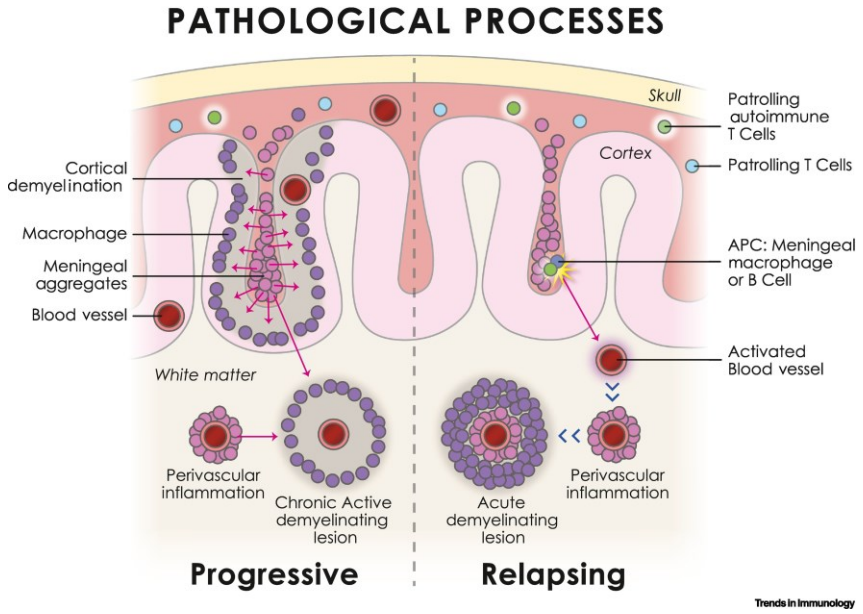
Et après? CAR T-cells ➔ MAI

Table 1. Published studies describing CAR T-cell application in autoimmune neurological diseases.

Publication	Study type	Disease	Antigen target	Patients (*n*)	CRS (*n*, grade)	ICANS (*n*, grade)	Construct
Qin et al.[8]	Phase I	NMOSD	BCMA	12	12, I–II	0	CT103A[a]
Granit et al.[9]	Phase Ib/IIa	MG	BCMA	14	0	0	Descartes-08[b]
Haghikia et al.[10]	Case report	MG	CD-19	1	0	0	KYV-101[c]
Tian et al.[11]	Case report	MG	BCMA	2	1, I	0	CT103A[a]
Zhang et al.[12]	Case report	CIDP	BCMA CD-19	1	1, I	0	Bispecific, human, 4-1BB
Fischbach et al.[13]	Case report	MS	CD-19	2	1, I	0	KYV-101
Motte et al.[14]	Case report	MG with LEMS	CD-19	2	2, I–II	1, I	KYV-101
Faissner et al.[15]	Case report	SPS	CD-19	1	1, II	0	KYV-101
Zhang et al.[16]	Case report	MG	BCMA CD-19	1	0	0	Bispecific, human, 4-1BB
Cabrera-Maqueda et al.[17]	Case report	MOGAD	CD-19	1	0	0	ARI-0001[d]
Wickel et al.[18]	Case report	LEMS	CD-19	1	1, II	0	KYV-101
Haghikia et al.[19]	Case report	MG with RA	CD-19	1	1, I	0	KYV-101
Vu et al.[20]	Phase IIb	MG	BCMA	18	0	0	Descartes-08
Dong et al.[21]	Case report	CIDP	BCMA	2	2, I	0	CT103A[a]
Pecher et al.[22]	Case report	MS with RA	CD-19	1	1, II	0	Murine, 4-1BB
Motte et al.[23]	Case report	APN	CD-19	2	2, I–II	1, I	KYV-101
Hegelmaier et al.[24]	Case report	AIE	CD-19	1	1, I	N/A	KYV-101
Total	–	–	–	63	26, I–II	2, I	–

- **Essais de phase I/II en cours**



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Conclusion

- **Indications rares des AHSCT en neurologie**
  - **SEP RR >>>> autres MAI**
  - **Pas/peu d'indication dans les SEP PP**
- **Autres types de greffe possibles:**
  - **SEP ➔ CSM**
  - **Maladies génétiques ➔ Allogreffe**
- **Futur?**
  - **Maladies neurodégénératives?**
  - **Autres types de greffe? Pour d'autres objectifs**
  - **CAR T-Cells?**