



STIMULATION MÉDULLAIRE ET PSPS TYPE II : ELECTRODES CHIRURGICALES VS PERCUTANÉES

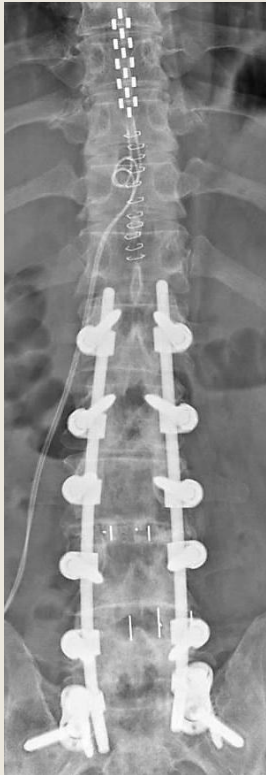
Évaluation quantitative de la couverture de la douleur par
cartographie numérique et analyse multidimensionnelle
des résultats cliniques

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INTRODUCTION

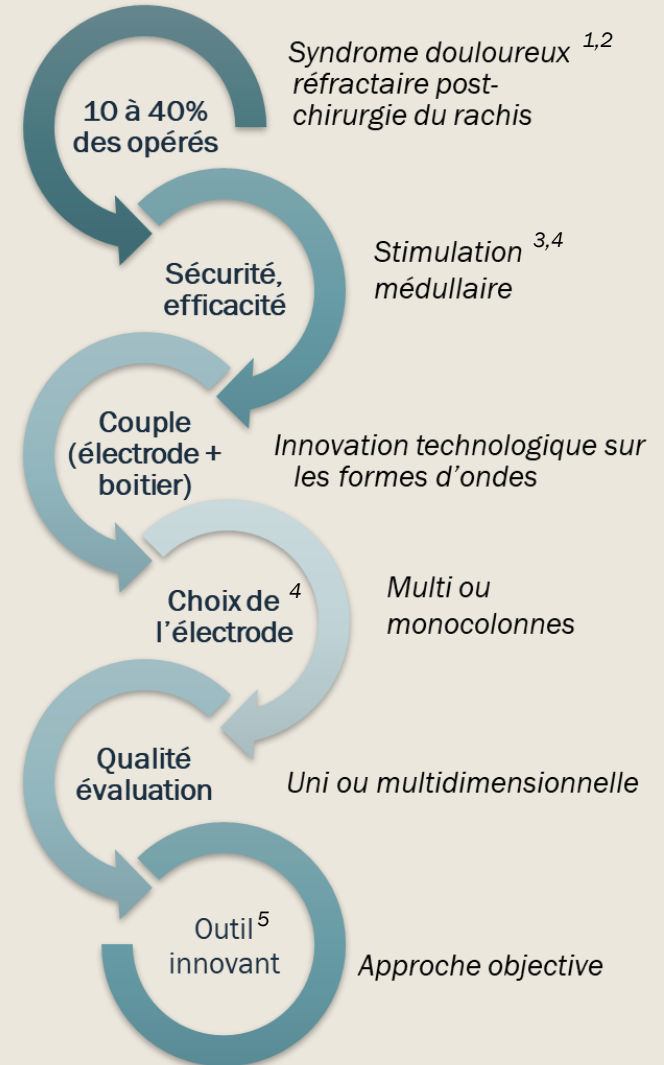
Persistent Spinal Pain Syndrome - type II



Multicolonne / Paddle
dite « chirurgicale »



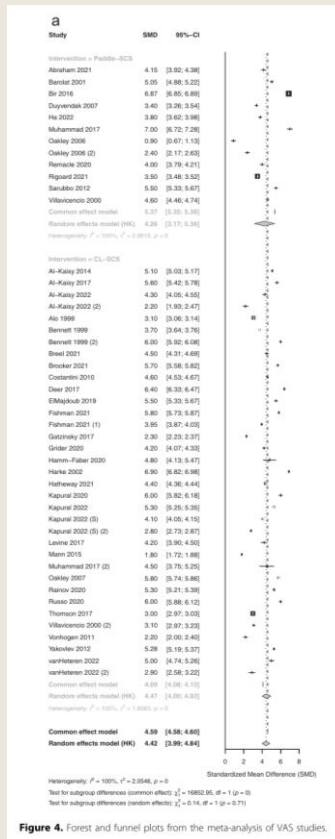
Monocolonne / Cylindrique
dite « percutanée »



1. Cristelis et al. 2021 2. Inoue et al. 2017
3. Huygen et al. 2024 4. El Hadwe et al. 2025 5. Rigoard et al. 2024

INTRODUCTION

Persistent Spinal Pain Syndrome - type II



Meta- analyse / Evaluation par EVA ou EN ⁴

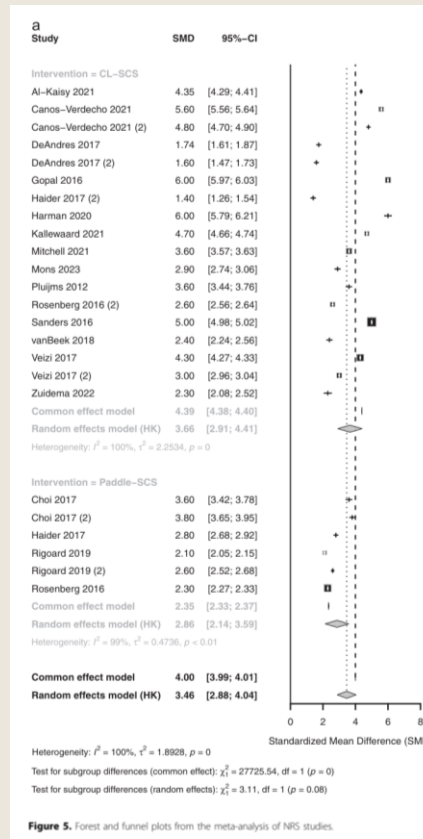
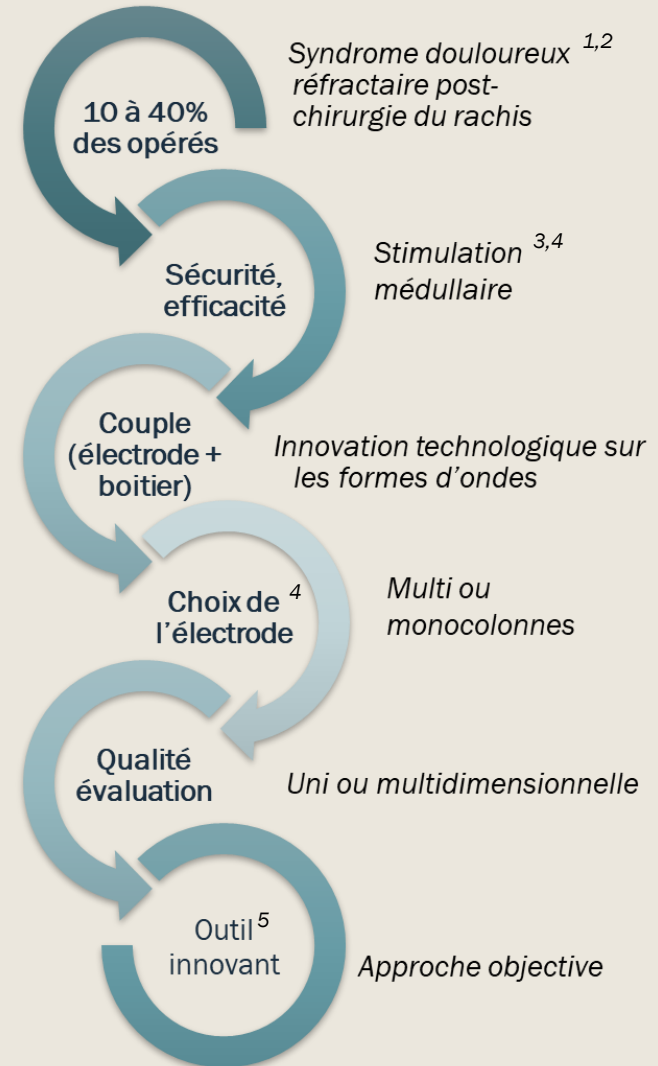


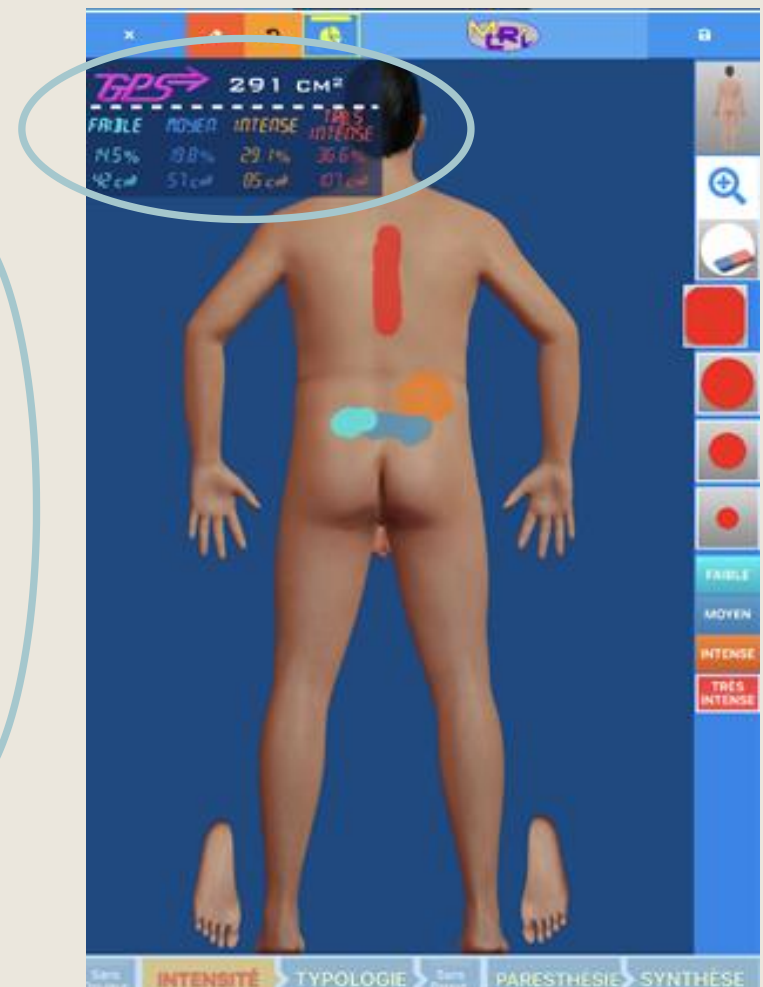
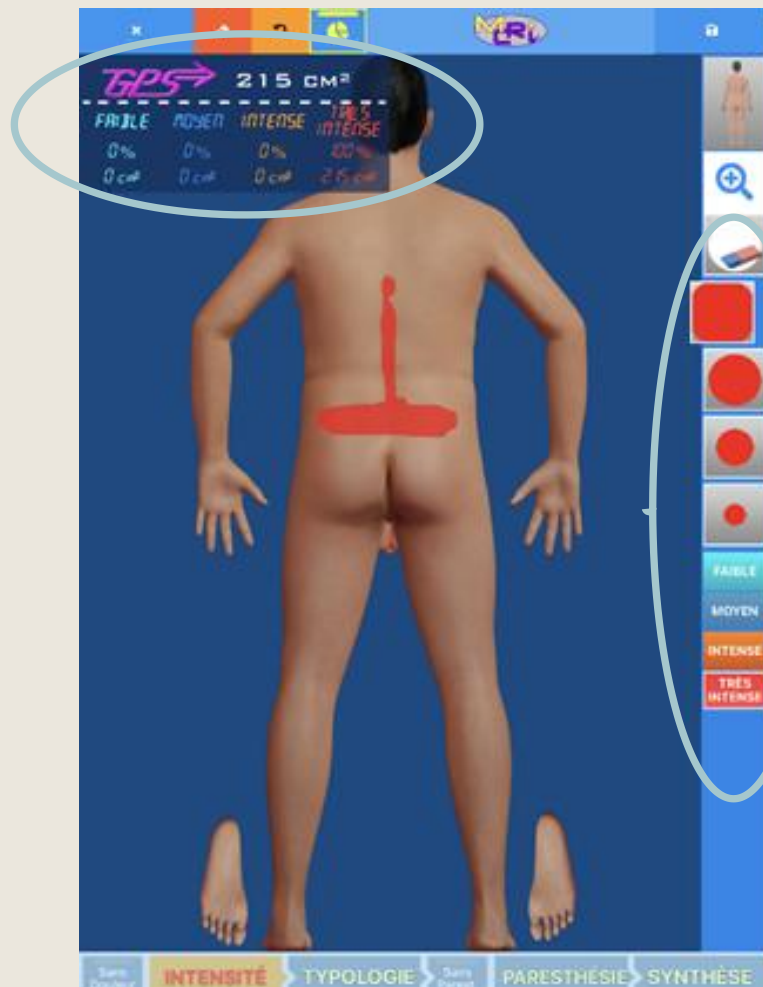
Figure 5. Forest and funnel plots from the meta-analysis of NRS studies.



1. Cristelis et al. 2021
2. Inoue et al. 2017
3. Huygen et al. 2024
4. El Hadwe et al. 2025
5. Rigard et al. 2024

PRISMAP^{1, 2, 3}

Cartographie numérique interactive et évaluation multidimensionnelle

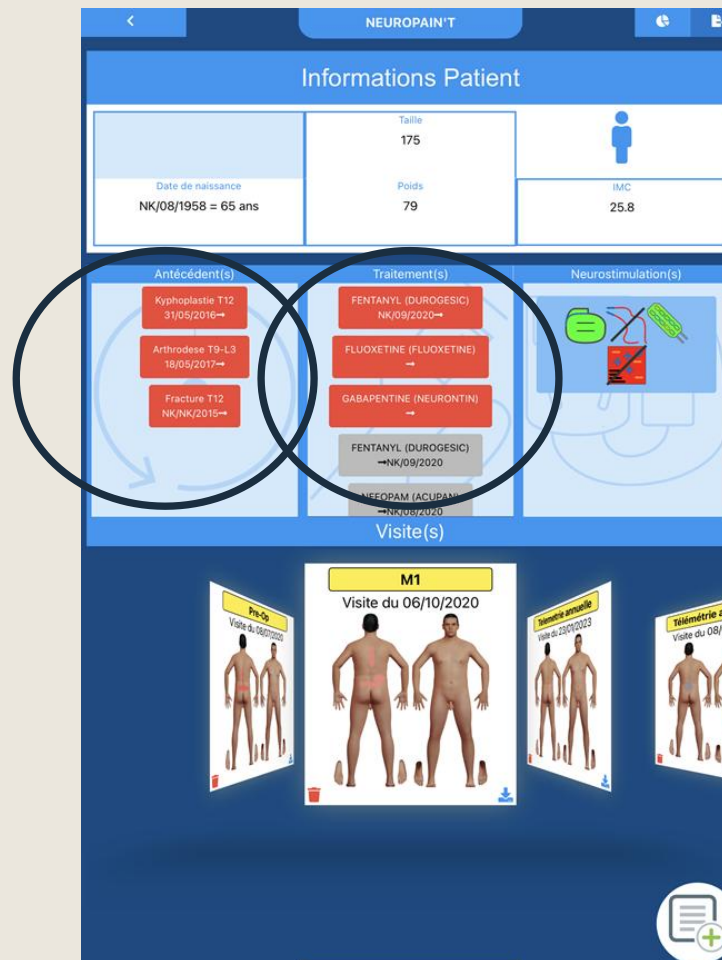


1. Rigoard et al. 2021 2. Rigoard et al. 2024 3. Billot et al. 2024

PRISMAP^{1, 2, 3}

Cartographie numérique interactive et évaluation multidimensionnelle

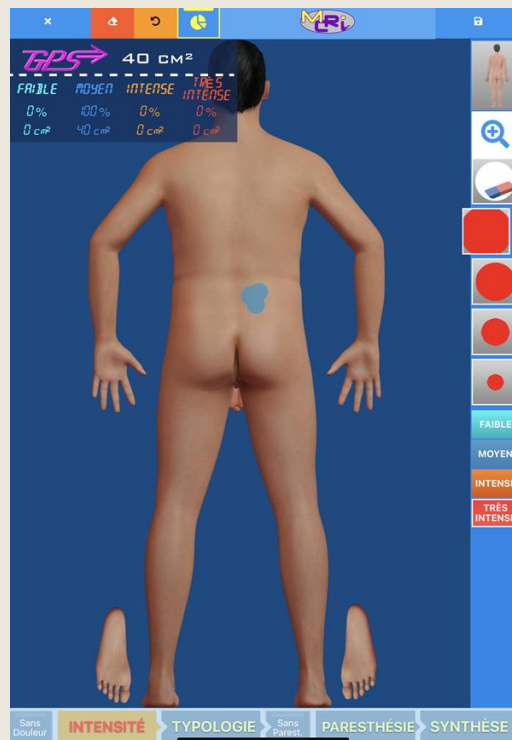
PSPS type II



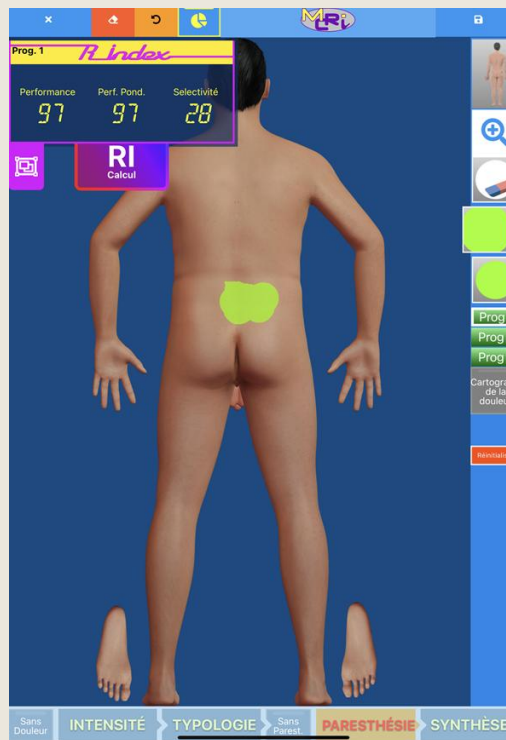
Réfractaire au
traitement
médicamenteux

PRISMAP^{1, 2, 3}

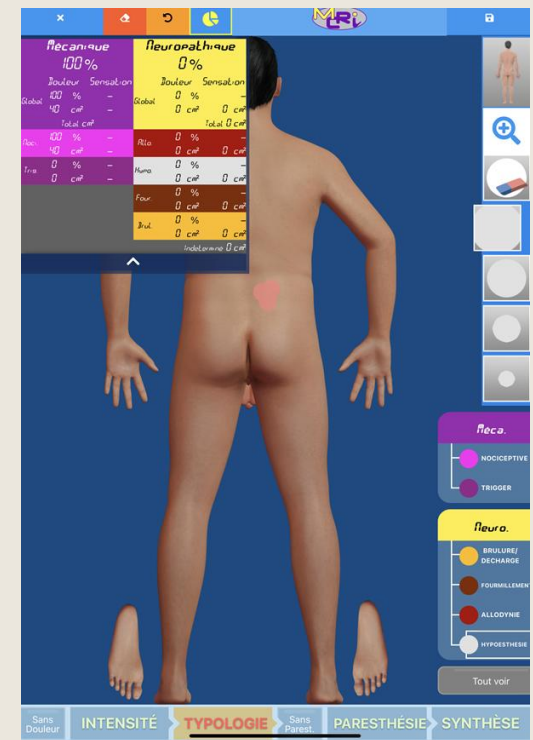
Cartographie numérique interactive et évaluation multidimensionnelle



Localisation et intensité douloureuse résiduelle à M12



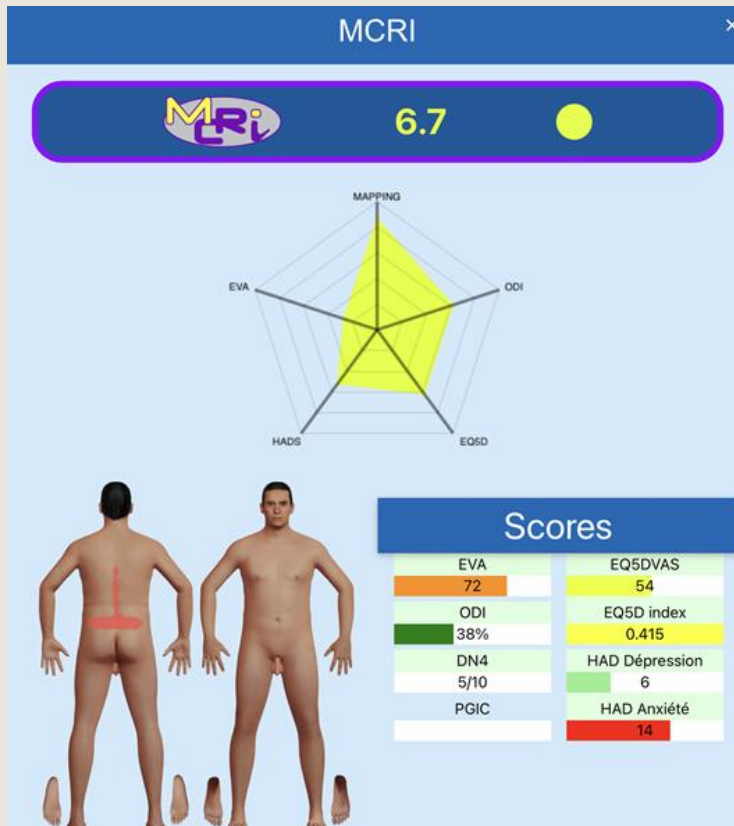
Couverture paresthésiante obtenue après implantation



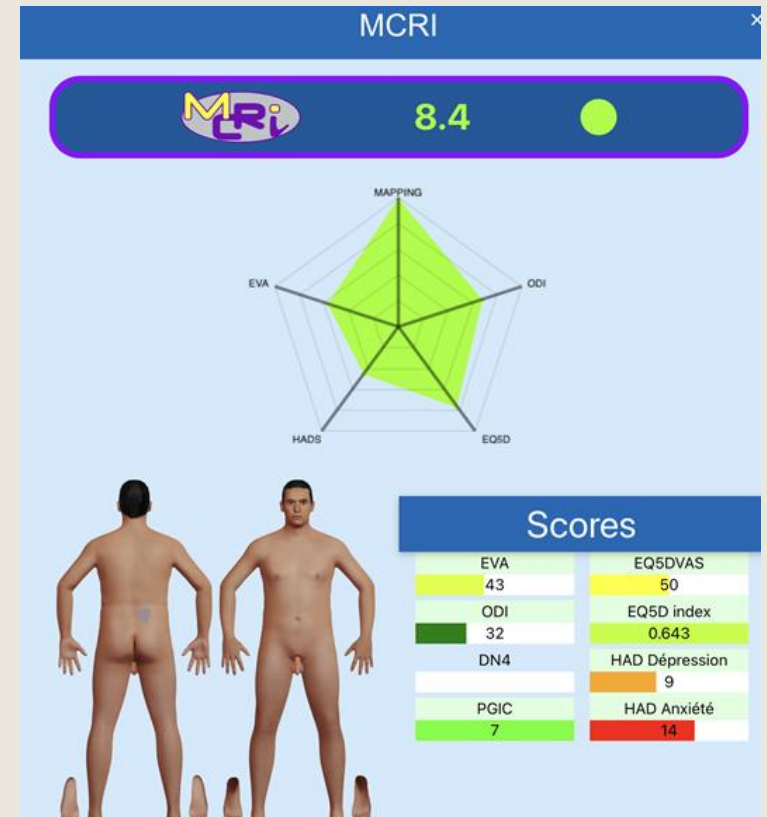
Type de douleur rapportée neuropathique / mécanique

PRISMAP^{1, 2, 3}

Cartographie numérique interactive et évaluation multidimensionnelle



Pré-implantation



Post-implantation

OBJECTIFS

Electrode chirurgicale ou percutanée : quel choix optimal ?



Comparer la couverture de la douleur entre les deux type d'électrodes



Évaluer les résultats cliniques sur 12 mois



Mesurer l'impact sur la qualité de vie



Identifier les risques et complications

METHODOLOGIE

Approche objective et innovante



Étude de cohorte en conditions réelles
Etude rétrospective (2018-2024)



175 patients PSPS-T2
Groupe chirurgical : 35
Groupe percutané : 140



Cartographie numérique
Multidimensional Clinical Response Index (MCRI)



Analyse statistique
Score de Propension pour comparer les groupes

POPULATION

Cohorte en conditions réelles

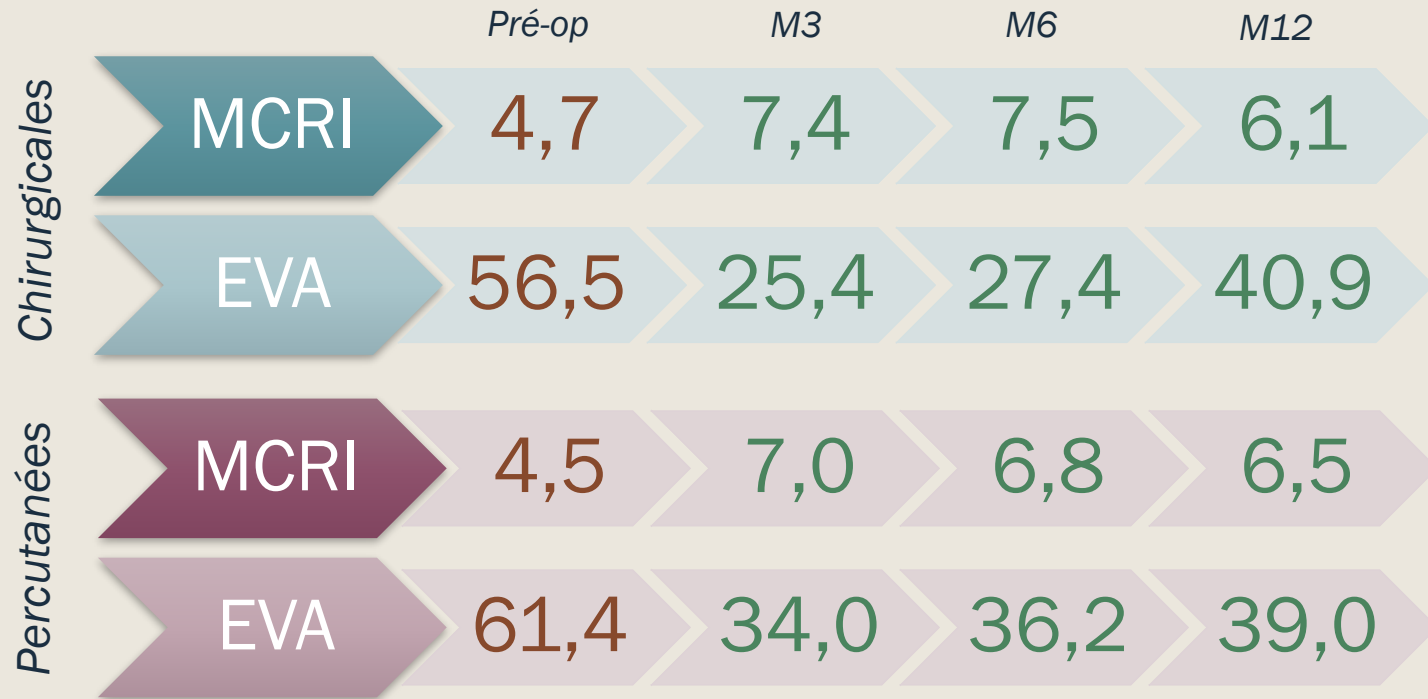
Table 1: Study population characteristics

Baseline variable	Paddle lead	Cylindrical lead
	n = 35	n = 140
Age	51.5 ± 12.8	50.3 ± 10.5
Sex (Male/Female)	45.8%/54.2%	42.2%/57.8%
Baseline VAS	63.2 ± 24.8	64.4 ± 16.8
Baseline ODI	48.5 ± 14.7	44.3 ± 13.9
Baseline anxiety HADS	8.6 ± 4.3	8.2 ± 4.2
Baseline depression HADS	9.5 ± 3.9	6.8 ± 3.9
Baseline pain surface*	771.6 (1038.1)	767.0 (639.3)
Baseline back pain surface*	479.9 (767.0)	488.9 (490.6)
Baseline leg pain surface*	329.9 (400.1)	322.4 (287.7)
Bilateral pain (%)	16.7%	10.8%
Indication		
Back and leg pain	41.7%	38.6%
Back pain only	45.8%	45.8%
Leg pain only	12.5%	15.7%
Implantation anesthesia		
general anesthesia	37.5%	1.2%
Awake anesthesia	62.5%	98.8%
Follow-up duration (months)	31.4 ± 26.0	13.4 ± 14.5

* Median and InterQuartile Range (IQR)

RÉSULTATS CLINIQUES

Amélioration clinique dès M3, quelque soit le type d'électrode



RÉSULTATS CLINIQUES : EN VIE RÉELLE

Amélioration clinique dès M3, quelque soit le type d'électrode

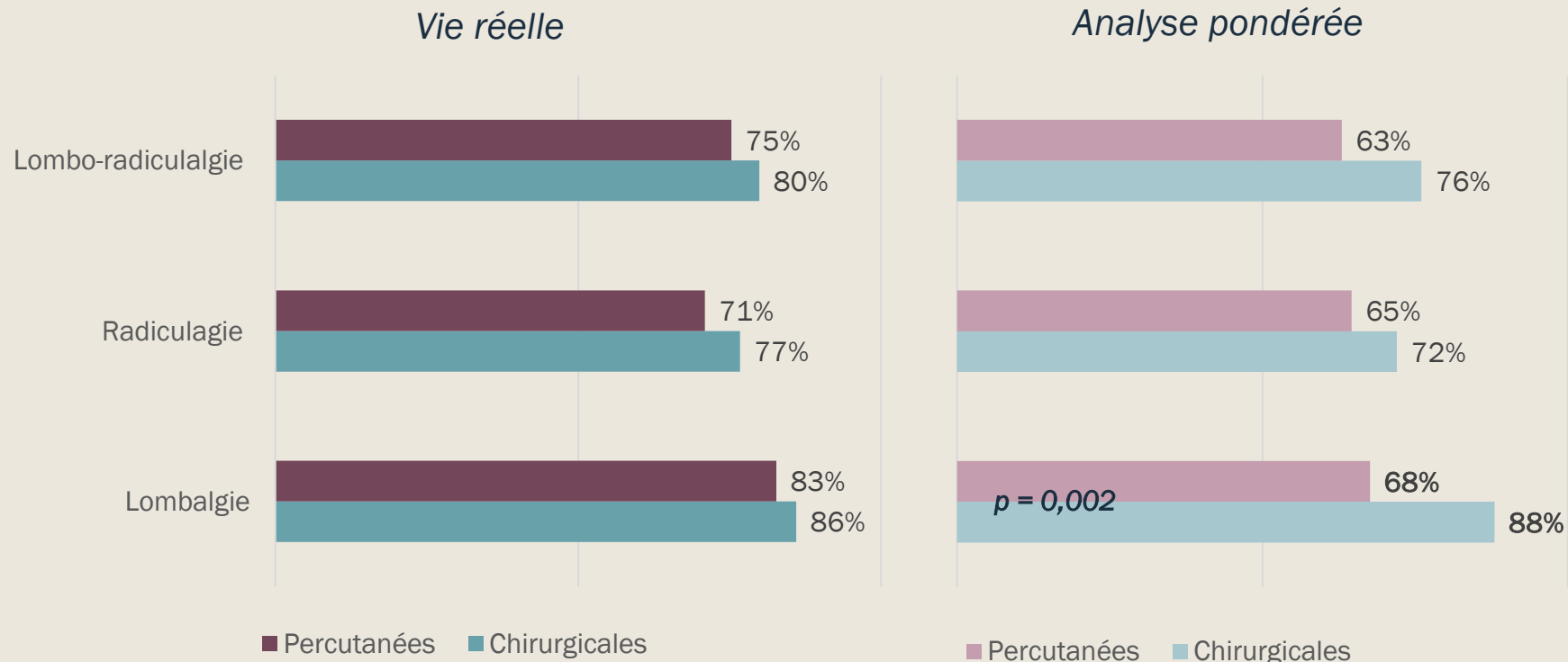
Table 4: Comparison of clinical endpoints between baseline and 3, 6 and 12-month follow-up. Estimated fixed effects and their standard error.

Change between baseline and follow-up	Paddle lead					Cylindrical lead				
	mean ± SD					mean ± SD				
	baseline	M+3	M+6	M+12	Time effect p-value	baseline	M+3	M+6	M+12	Time effect p-value
MCRI	4.7 (0.70)	7.4 (0.84)	7.5 (0.83)	6.1 (0.78)	0.005	4.5 (0.23)	7.0 (0.25)	6.8 (0.26)	6.5 (0.28)	< 0.0001
Pain VAS	56.5 (7.3)	25.4 (8.4)	27.4 (8.2)	40.9 (8.1)	0.001	61.4 (2.2)	34.0 (2.6)	36.2 (2.8)	39.0 (3.2)	< 0.0001
ODI	52.7 (1.3)	35.9 (4.0)	35.1 (4.0)	37.6 (4.0)	0.0003	43.0 (1.4)	29.6 (1.4)	29.9 (1.5)	31.6 (1.7)	< 0.0001
EQ-5D	0.40 (0.08)	0.48 (0.08)	0.51 (0.08)	0.47 (0.08)	0.6	0.38 (0.03)	0.56 (0.02)	0.54 (0.02)	0.51 (0.03)	< 0.0001
HADS anxiety	8.9 (1.1)	6.6 (1.2)	6.5 (1.1)	6.9 (1.1)	0.2	7.4 (0.3)	5.9 (0.3)	6.1 (0.4)	6.1 (0.4)	< 0.0001
HADS depression	9.2 (1.0)	6.0 (1.2)	5.6 (1.1)	5.9 (1.1)	0.01	6.7 (0.3)	4.4 (0.4)	4.2 (0.4)	4.3 (0.4)	< 0.0001

* Percentage of pain coverage weighted by pain intensity (Very intense pain = 4, intense pain = 2, 1 = moderate, 0.5 = low)

RÉSULTATS CLINIQUES

Performance de couverture paresthésiante



RÉSULTATS CLINIQUES : EN VIE RÉELLE

En vie réelle, pas de différence sur les résultats cliniques

change between follow-up and baseline	Paddle lead mean ± SD	Cylindrical lead mean ± SD	Difference CI95%	p-value
M+3	n = 13	n = 110		
MCRI	2.6 ± 3.4	2.4 ± 2.6	0.2 [-2.4, 2.9]	0.85
Pain VAS	-30.3 ± 30.4	-26.9 ± 29.2	-3.3 [-24.2, 17.6]	0.73
ODI	-17.2 ± 17.6	-13.1 ± 16.0	-4.1 [-15.6, 7.3]	0.45
EQ-5D	0.08 ± 0.36	0.18 ± 0.22	-0.10 [-0.36, 0.16]	0.42
HADS anxiety [†]	-1.5 (2.3)	-1 (4)	-1 [-2.0, 2.0]	0.56
HADS depression [†]	-3.5 (3)	-2 (4)	-1 [-3.0, 2.0]	0.42
PGIC [†]	6 (1)	6 (2)	0 [-0.0, 0.0]	0.33
M+6	n = 17	n = 89		
MCRI	2.7 ± 2.8	2.2 ± 2.4	0.5 [-1.5, 2.5]	0.60
Pain VAS	-30.3 ± 27.6	-23.3 ± 28.2	-6.9 [-17.0, 9.3]	0.37
ODI	-12.9 ± 14.3	-12.7 ± 14.3	-0.2 [-8.4, 8.1]	0.97
EQ-5D	0.10 ± 0.32	0.15 ± 0.24	-0.05 [-0.27, 0.17]	0.62
HADS anxiety [†]	-1 (5.5)	-1 (4)	0 [-2.0, 2.0]	0.73
HADS depression [†]	-3.5 (3.5)	-2 (4)	-1 [-3.0, 1.0]	0.27
PGIC [†]	6 (2)	6 (2)	0 [-1.0, 0.0]	0.85
M+12	n = 21	n = 59		
MCRI	2.5 ± 3.2	1.9 ± 2.7	0.7 [-1.5, 2.8]	0.52
Pain VAS	-23.6 ± 34.9	-18.9 ± 32.8	-4.6 [-23.7, 14.5]	0.62
ODI	-10.5 ± 16.0	-10.8 ± 16.2	0.3 [-8.4, 9.0]	0.95
EQ-5D	0.08 ± 0.32	0.12 ± 0.22	-0.04 [-0.24, 0.16]	0.69
HADS anxiety [†]	-1 (2.5)	-1 (4)	-0 [-2.0, 2.0]	0.88
HADS depression [†]	-3 (4)	-1 (4)	-1 [-3.0, 1.0]	0.19
PGIC [†]	6 (2)	6 (2)	0 [-1.0, 0.0]	0.72

[†] Median (IQR) and Mann-Whitney test with a median of the difference in location and its 95% confidence interval.

PAS DE DIFFÉRENCE

RÉSULTATS CLINIQUES : EN ANALYSE PONDÉRÉE

En analyse pondérée, différences en faveur du groupe chirurgical

Table 6: Overlap propensity-weighted comparison of clinical endpoints between Paddle and cylindrical leads at 3, 6 and 12-month follow-up.

change between baseline and follow-up	Paddle lead mean ± SD	Cylindrical lead mean ± SD	Difference CI95%	p-value
M+3	n = 13	n = 110		
MCRI	2.4 ± 2.6	2.1 ± 2.7	0.3 [-1.8, 2.3]	0.80
Pain VAS	-28.0 ± 24.2	-17.9 ± 24.9	-10.1 [-27.2, 7.0]	0.27
ODI	-12.4 ± 14.4	-15.4 ± 17.6	3.0 [-7.1, 13.1]	0.57
EQ-5D	0.02 ± 0.21	0.22 ± 0.16	-0.19 [-0.34, -0.03]	0.041
HADS anxiety [†]	-3 (1)	0 (5)	-2.5 [-4.5, 0.5]	0.13
HADS depression [†]	-4 (7)	-4 (8)	-2.5 [-5.5, 0.5]	0.14
PGIC [†]	7 (2)	6 (1)	0.5 [-0.0, 1.0]	0.11
M+6	n = 17	n = 89		
MCRI	2.8 ± 2.6	1.6 ± 2.3	1.3 [-0.8, 3.3]	0.27
Pain VAS	-32.0 ± 28.6	-14.8 ± 20.1	-17.2 [-36.7, 2.3]	0.12
ODI	-11.8 ± 12.1	-13.5 ± 18.2	1.7 [-7.7, 11.1]	0.73
EQ-5D	0.07 ± 0.28	0.17 ± 0.27	-0.10 [-0.32, 0.12]	0.41
HADS anxiety [†]	-3 (6)	0 (6)	-3 [-5.5, -0.5]	0.09
HADS depression [†]	-3 (7)	-4 (7)	2 [-1.0, 4.5]	0.18
PGIC [†]	6 (2)	5 (2)	1 [-0.5, 1.5]	0.20
M+12	n = 21	n = 59		
MCRI	3.5 ± 2.5	1.5 ± 2.6	2.0 [0.4, 3.6]	0.022
Pain VAS	-34.1 ± 32.4	-11.0 ± 28.9	-23.1 [-39.9, -6.4]	0.012
ODI	-12.0 ± 17.2	-9.0 ± 15.1	-2.9 [-11.7, 5.8]	0.51
EQ-5D	0.04 ± 0.20	0.20 ± 0.23	-0.16 [-0.04, -0.29]	0.020
HADS anxiety [†]	-1 (3)	-1 (5)	0 [-2.0, 2.0]	0.9
HADS depression [†]	-4 (5)	-1 (6)	-1 [-3.0, 1.0]	0.36
PGIC	6 (2)	5 (3)	0.5 [-0.5, 1.5]	0.21

[†] Median (IQR) and Mann-Whitney test with a median of the difference in location and its 95% confidence interval.

DISCUSSION

En vie réelle, pas de différence significative...

- En analyse pondérée, différences en faveur de l'électrode chirurgicale

... des groupes différents avant l'implantation

- Rôle majeur de l'évaluation, la sélection et l'indication pré-opératoire !

Abord percutané : 1 ou 2 monocolonnes ?

- Différences de pratique en France et à l'international (USA)

Texte complet

Neuromodulation 2025

ARTICLE IN PRESS

Neuromodulation: Technology at the Neural Interface

Received: March 19, 2025 Revised: July 18, 2025 Accepted: July 27, 2025

<https://doi.org/10.1016/j.neurom.2025.07.009>

Surgical vs Percutaneous Spinal Cord Stimulation for Persistent Spinal Pain Syndrome Type 2: A Digital Pain Mapping and Pain Coverage Quantitative Assessment Combined With Multidimensional Clinical Outcome Study

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