



Place de la chirurgie de l'épilepsie chez l'enfant ?

Groupe de Neurophysiologie Clinique de l'Enfant , Juin 2025

Dr Marie-Thérèse DANGLES



HÔPITAL FONDATION
Adolphe de ROTHSCHILD
LA RÉFÉRENCE TÊTE ET COU

Service de Neurochirurgie Pédiatrique
Hôpital Fondation Adolphe de Rothschild



Chirurgie de l'épilepsie chez l'enfant?

- Quand penser à cet outil?
 - Etiologies
 - Pharmacorésistance
- Méthodes ?
 - Chirurgie curative
 - Chirurgie non curative
- Objectifs
 - Crises
 - Développement

Quand penser à la chirurgie?



ILAE 2006 Pediatric Epilepsy Surgery Recommendations

Epilepsia, 47(6):952–959, 2006
Blackwell Publishing, Inc.
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Original Research

Proposed Criteria for Referral and Evaluation of Children for Epilepsy Surgery: Recommendations of the Subcommission for Pediatric Epilepsy Surgery

*J. Helen Cross, *Prasanna Jayakar, *Doug Nordli, *Olivier Delalande, *Michael Duchowny,
†Heinz G. Wieser, ‡Renzo Guerrini, and *Gary W. Mathern

*On behalf of the International League Against Epilepsy *Subcommission for Paediatric Epilepsy Surgery, and
the Commissions of †Neurosurgery and ‡Paediatrics*

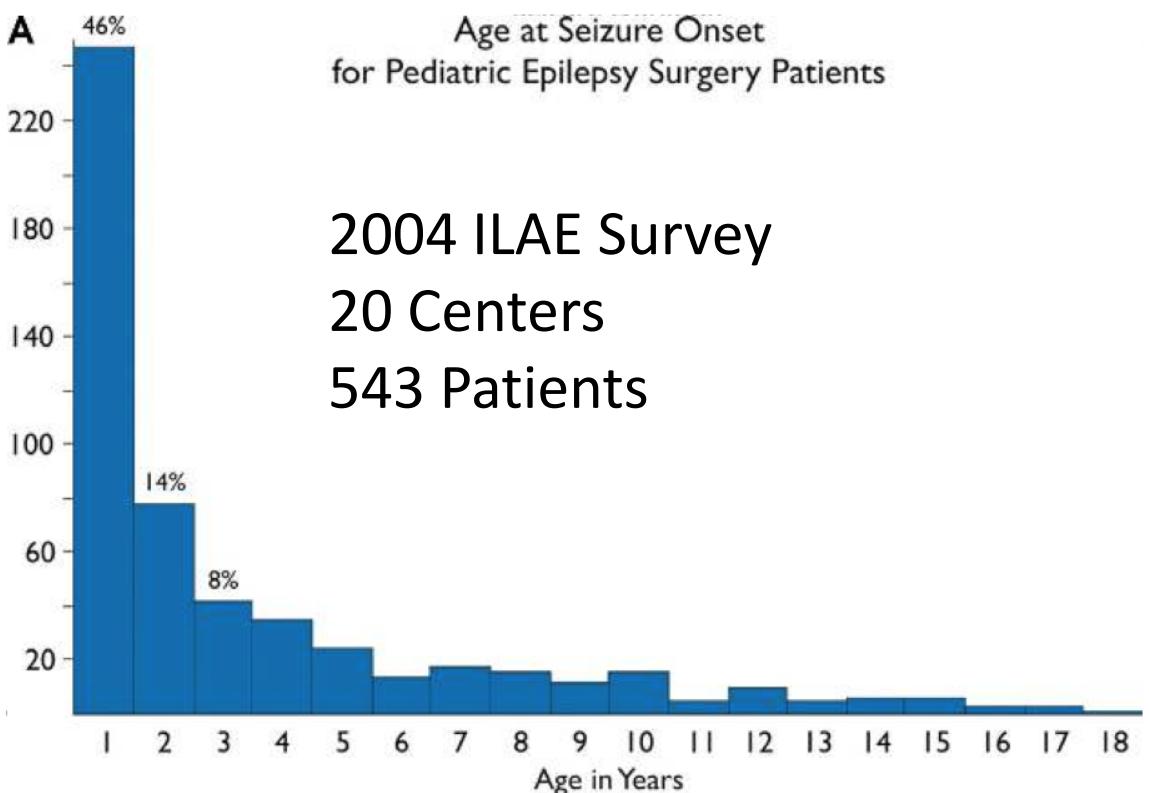
Recognized etiologies and syndromes
include the following:

- 1. **Cortical dysplasia**
- 2. **STB**
- 3. **Polymicrogyria**
- 4. **Hypothalamic Hamartoma**
- 5. **Hemispheric syndromes: HHE, Rasmussen...**
- 6. **Sturge Weber**
- 7. **Landau Kleffner (Multiple Subpial
Transsection)**

SPECIAL REPORT

Defining the spectrum of international practice in pediatric epilepsy surgery patients

*†Simon Harvey, ‡ J. Helen Cross, §Shlomo Shinnar, ¶Bary W. Mathern,
and the ILAE Pediatric Epilepsy Surgery Survey Taskforce*



Etiologies

I. Cortical dysplasia ^a	42.4% (n = 175)
A. Hemimegalencephaly	10% (n = 17)
B. Hemispheric CD	12% (n = 21)
C. Multilobar CD	19% (n = 34)
D. Lobar/focal	59% (n = 103)
II. Tumor	19.1% (n = 79)
A. DNET	29% (n = 23)
B. Ganglioglioma	28% (n = 22)
C. Other tumor	43% (n = 34)
III. Atrophy/stroke (not Rasmussen)	9.9% (n = 41)
A. Stroke	44% (n = 18)
B. Unspecific atrophy	49% (n = 20)
C. Trauma	7% (n = 3)
IV. Hippocampal sclerosis ^b	6.5% (n = 27)
V. Gliosis/normal pathology	6.3% (n = 26)
VI. Tuberous sclerosis complex	5.1% (n = 21)
VII. Hypothalamic hamartoma	3.6% (n = 15)
VIII. Sturge–Weber	2.9% (n = 12)
IX. Rasmussen syndrome	2.7% (n = 11)
X. Vascular (not Sturge–Weber)	1.5% (n = 6)

Pharmacorésistance (ILAE 2010)

- *Echec*
- *Deux essais thérapeutiques (monothérapie ou association)*
- *Bien :*
 - *Choisis (syndrome/étiologie)*
 - *Menés (posologies mg/kg/j, associations)*
 - *Tolérés (effets indésirables)*

Rationnel: Après 2 essais thérapeutiques, peu de chances d'obtenir liberté de crise
=> Référer en centre expert chirurgical

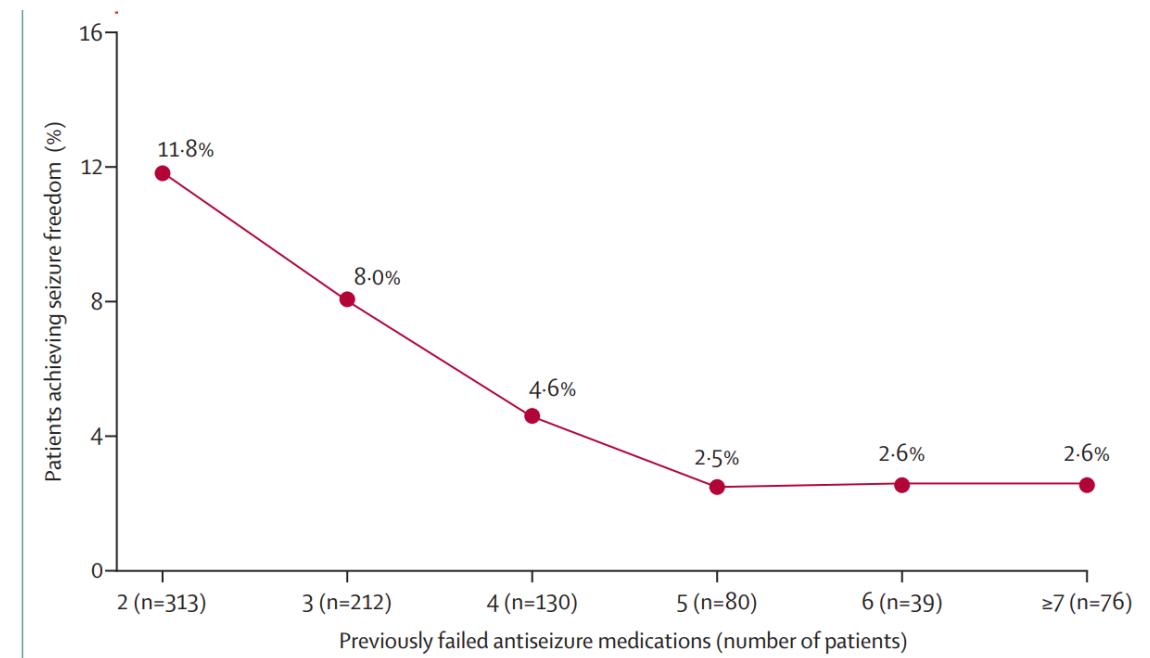
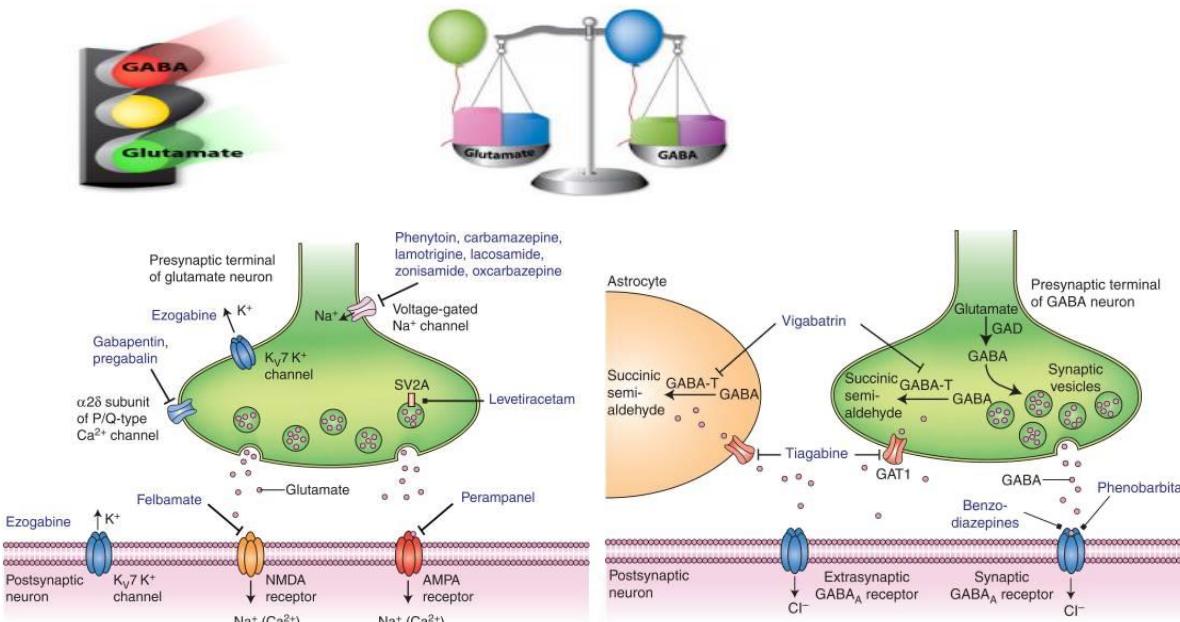


Figure 1: Seizure freedom rates after a newly added antiseizure medication, by number of previously tried antiseizure medications

Stratégies anti-crises et anti-épileptiques

Traitements modifiant la neurotransmission



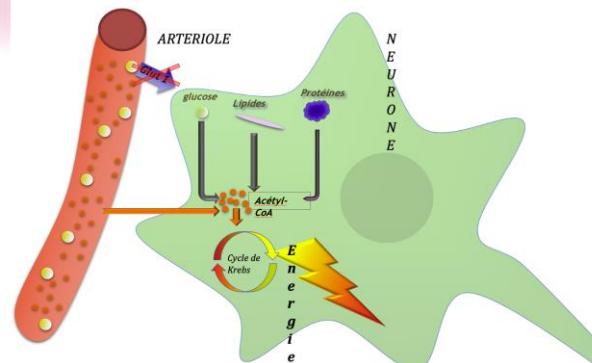
Mechanisms of Action of Antiseizure Drugs
and the Ketogenic Diet
Cold Spring Harb Perspect Med. 2016 May 2;6(5)

Michael A. Rogawski¹, Wolfgang Löscher², and Jong M. Rho^{3,4,5}

Traitements spécifiques

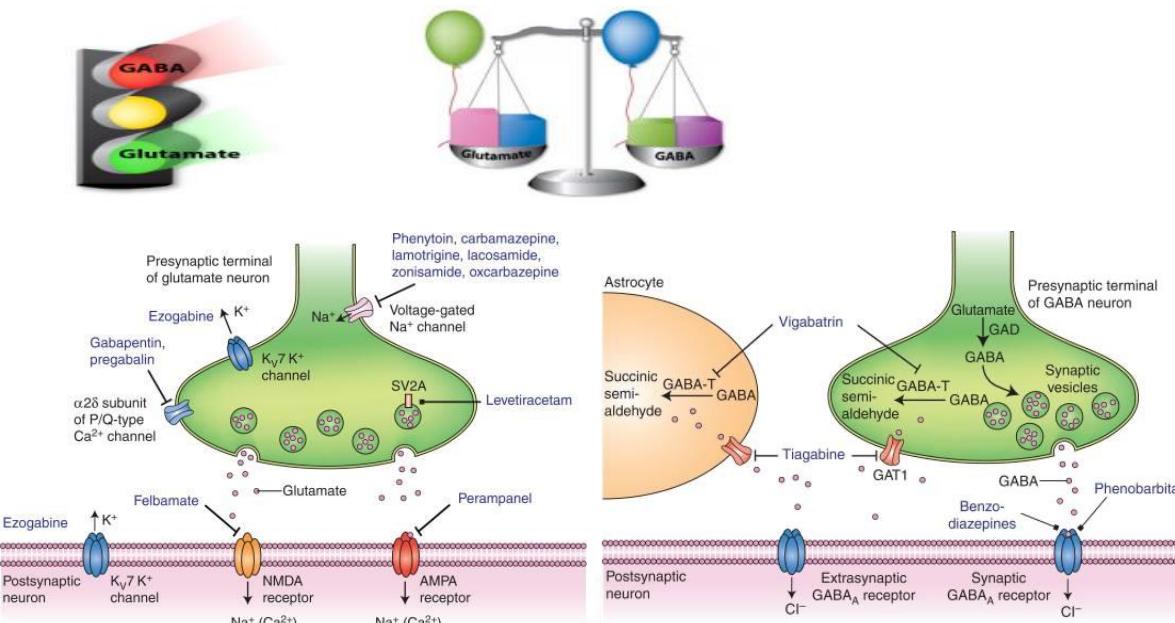
- Crises vitamino sensibles
- Crises nicotinamides sensibles
- GLUT-1

Régime Cétogène



Stratégies anti-crises et anti épileptiques

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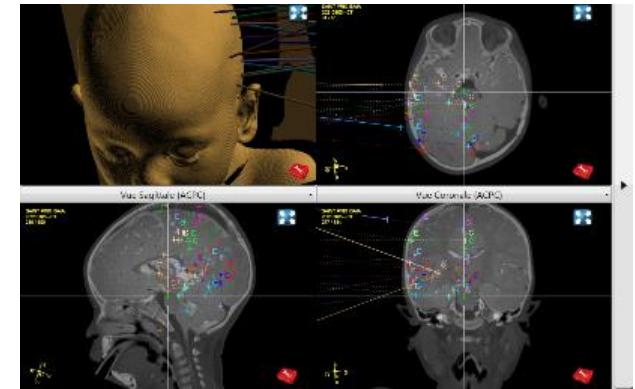
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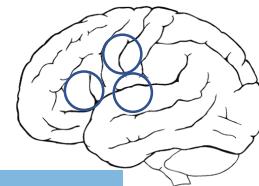
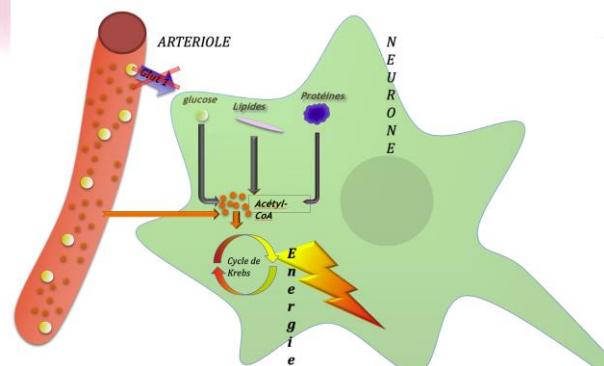
Traitements spécifiques

- Crises vitamino sensibles
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Chirurgies

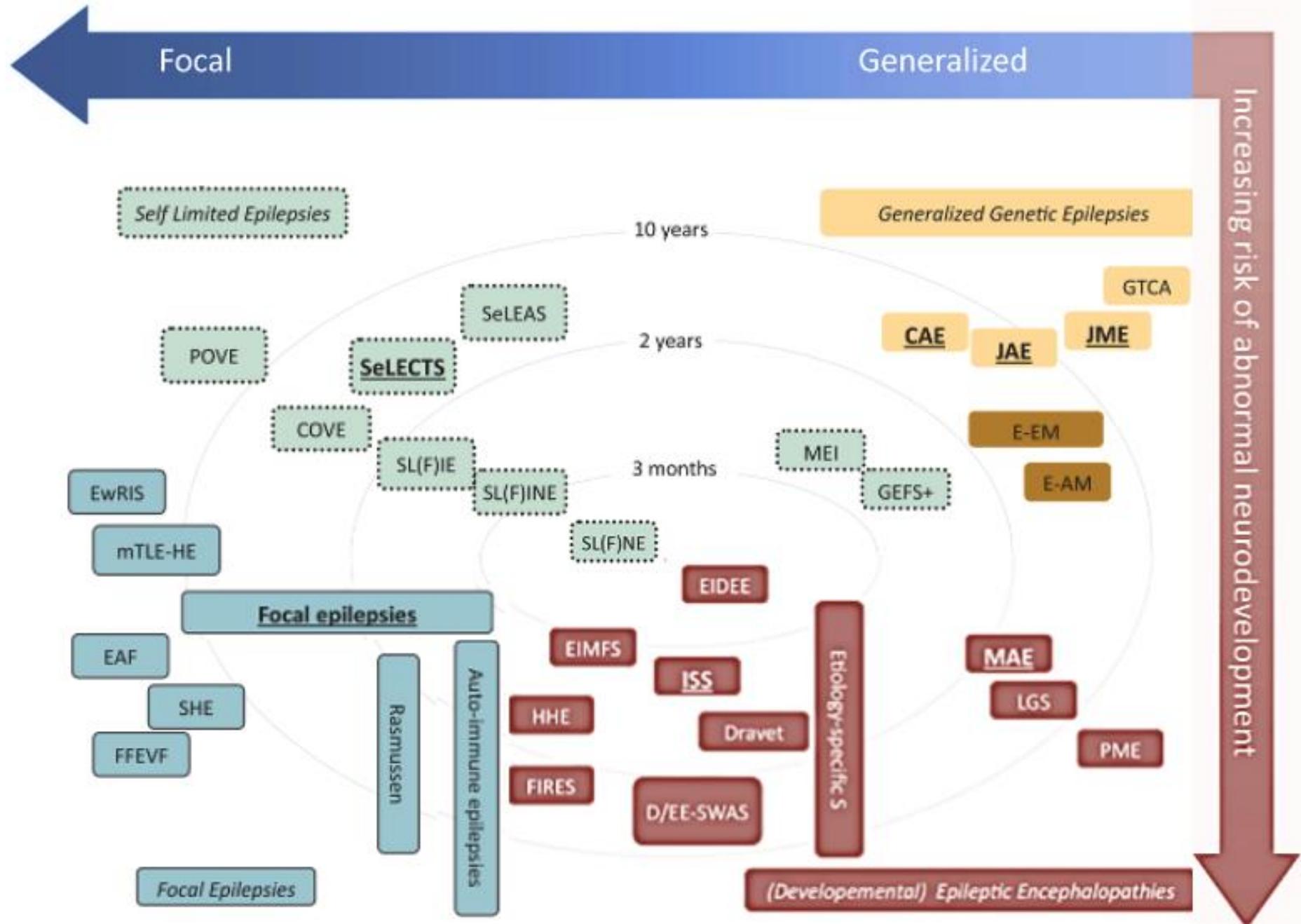


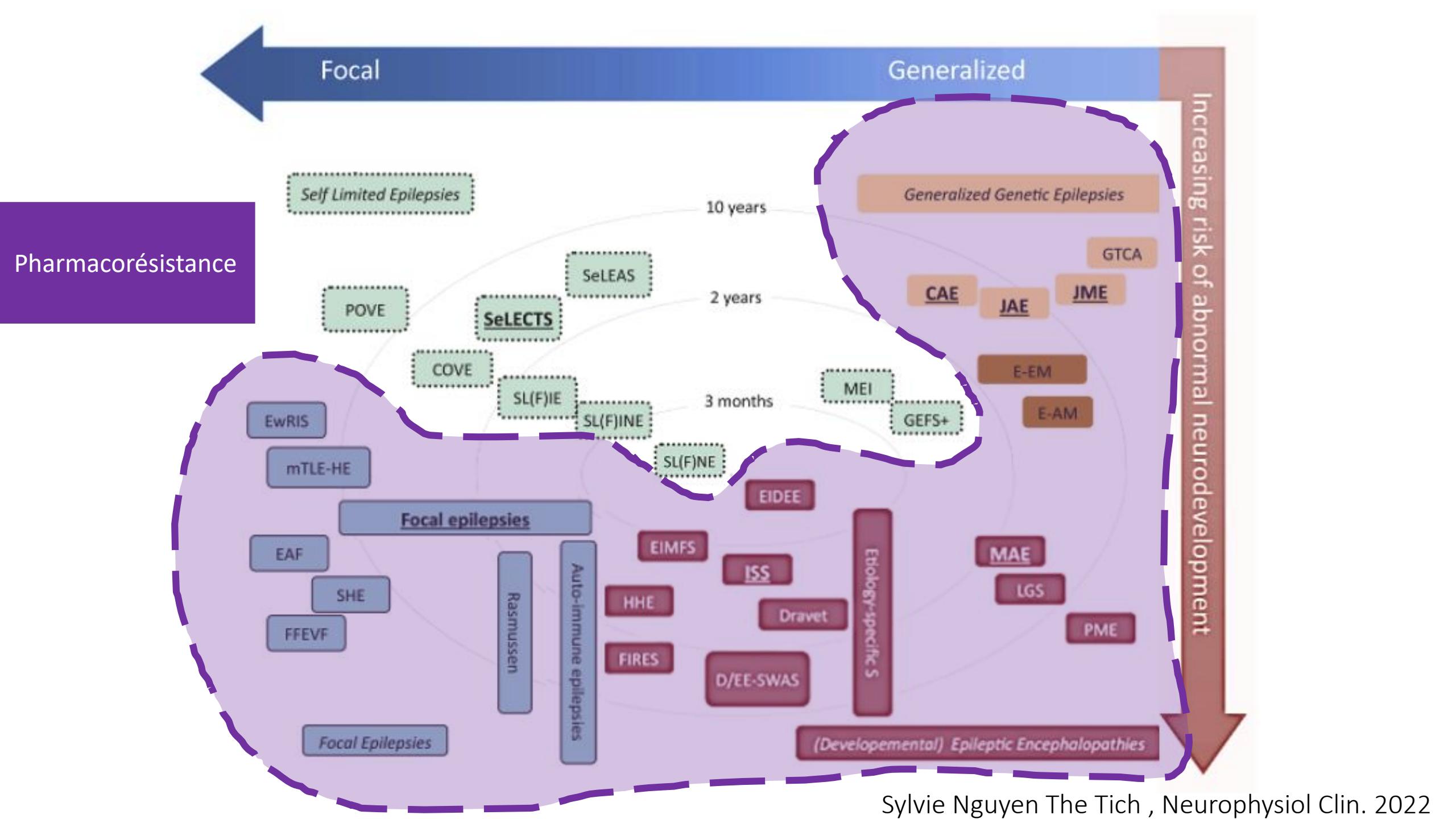
Régime Cétogène



Neuromodulation

- Stimulation du Nerf Vague (VNS)
- DBS
- RNS (pas en France)



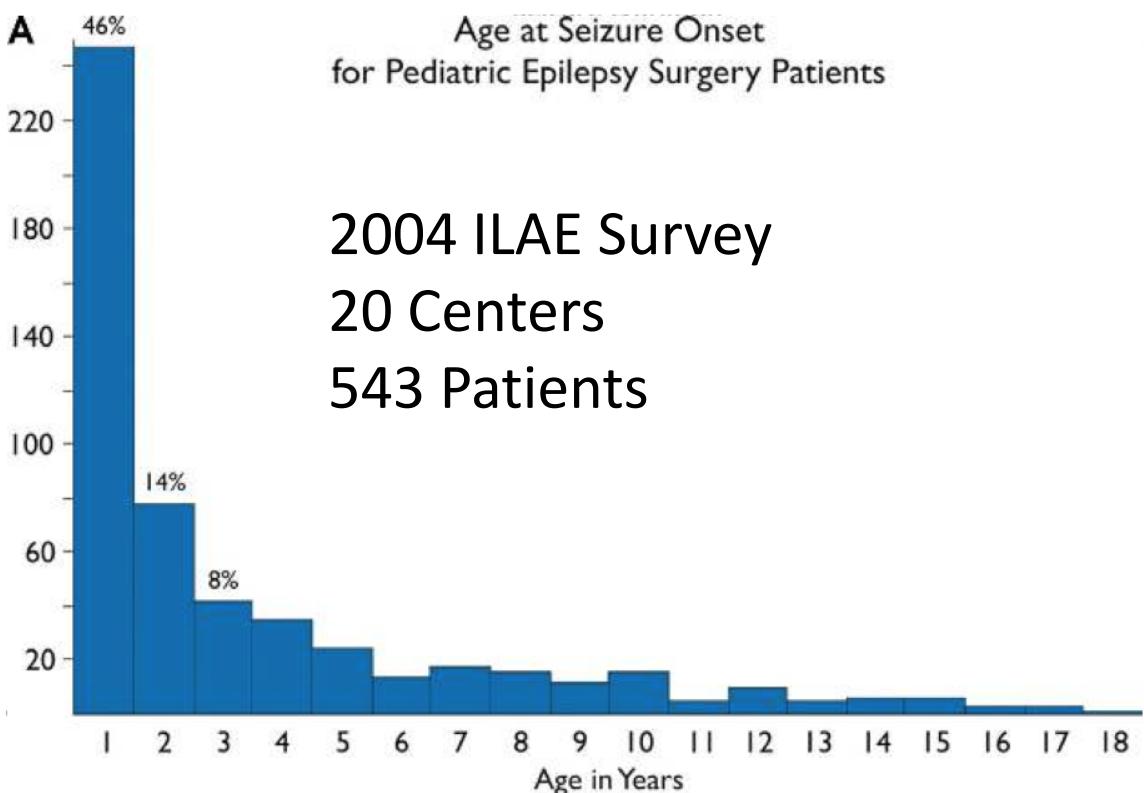


Chirurgies curatives

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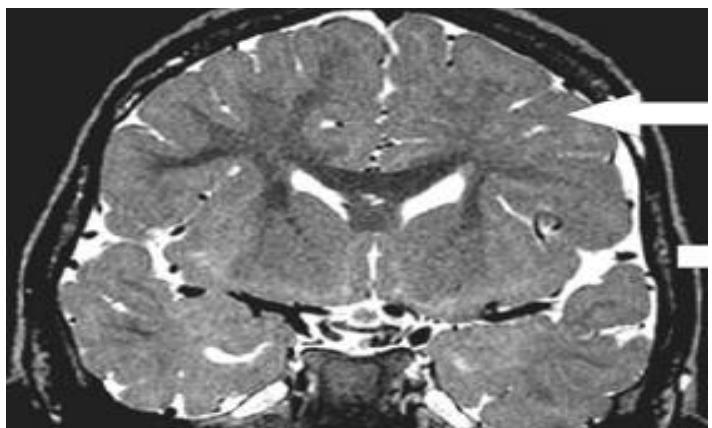
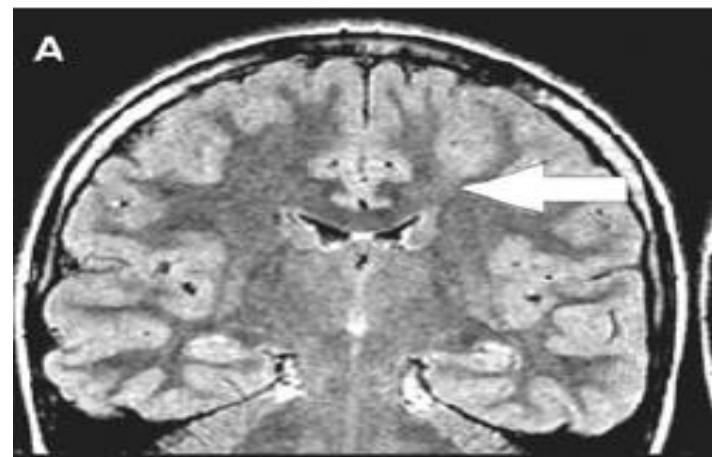
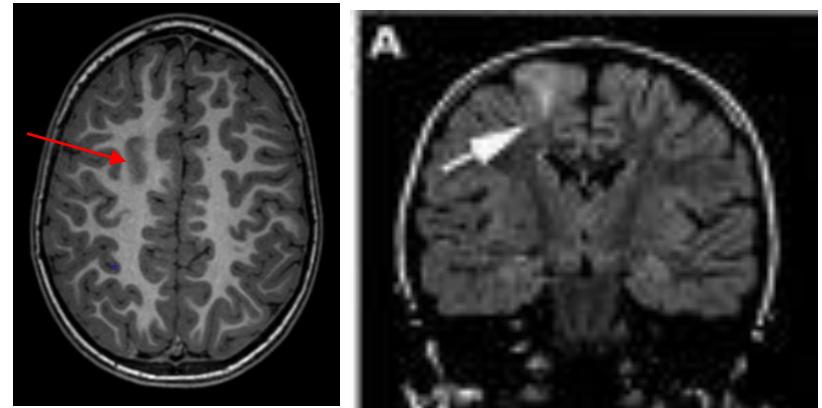
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Dysplasie corticale focale

- IRM +/- anormale
- Classification (Blümcke et al., 2011, Barkovich, 2012)

- **Type I** abnormal radial/tangential lamination
- **Type II**
 - **IIa** with large, **dysmorphic neurons**
 - **IIb:** with large, dysmorphic neurons and **balloon cells**, including **transmantle** dysplasia and bottom of sulcus dysplasia (« queue de radis »)
- Type **III: FCD** + hippocampal sclerosis /Tumor/vascular malformation



Seizure Outcome After Surgery for MRI-Diagnosed Focal Cortical Dysplasia

A Systematic Review and Meta-analysis

Anna Willard, MD, FRACP, Ana Antonic-Baker, PhD, Zhibin Chen, PhD,
Terence John O'Brien, MBBS, MD, FRACP, Patrick Kwan, MBBChir, PhD, FRCP, FRACP, and
Piero Perucca, MD, PhD, FRACP

Neurology® 2022;98:e236-e248. doi:10.1212/WNL.00000000000013066

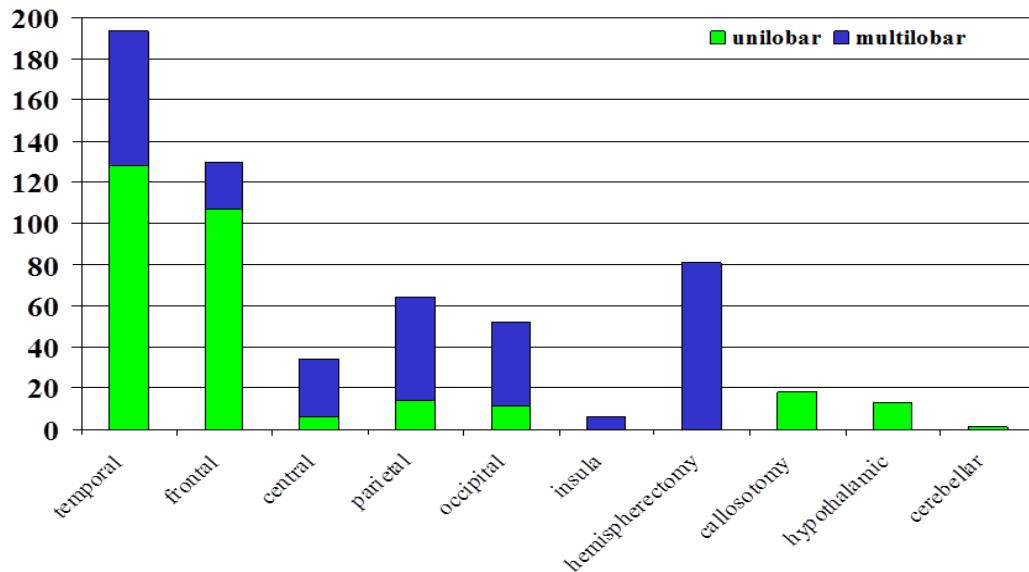
Correspondence

Dr. Perucca
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unimelb.edu.au

- Tous âges confondus
- DCF à IRM (+)
 - 70% d'évolution favorable post-opératoire (67% seizure-free)
 - FdBP:
 - **Résection complète** (arguments: anapath marges de résection+ ECOG + IRM postop)
 - **Localisation temporelle**
 - Pas d'influence: extension lésionnelle, nécessité SEEG, histologie DCF (mais IRM(+) !!)

Dysplasie corticale focale

- IRM normale ne doit pas exclure le parcours chirurgical en cas d'événements stéréotypés
- Intérêt de la SEEG pour optimiser une résection complète
- Même si la focalisation semble large (multilobaire)



Recueil International pédiatrique (Harvey, 2008)

Multilobaire:

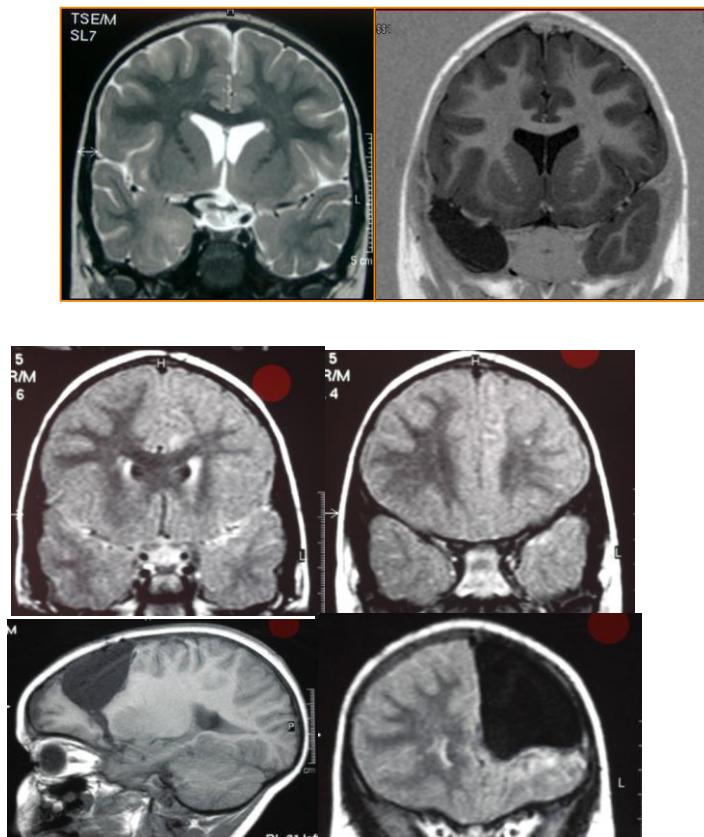
Harvey, 2008: 63%

Cossu, 2005 et Gonzales-Martinez, 2014: 34-44% après sEEG

Cossu, 2012 chez <45 mois: 54%

Résection/Déconnexion

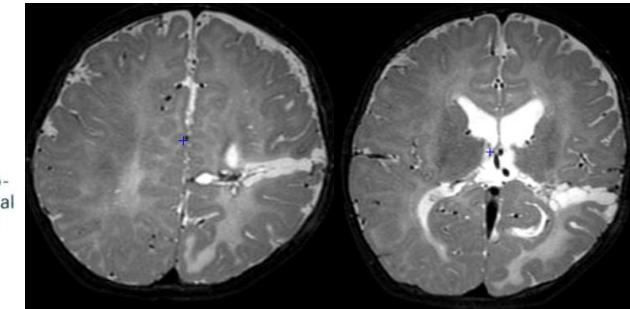
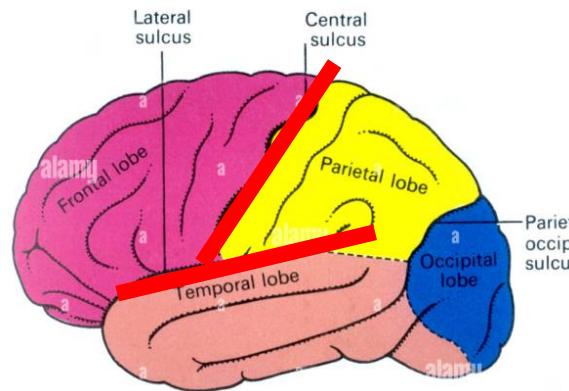
Résection->Lobectomy



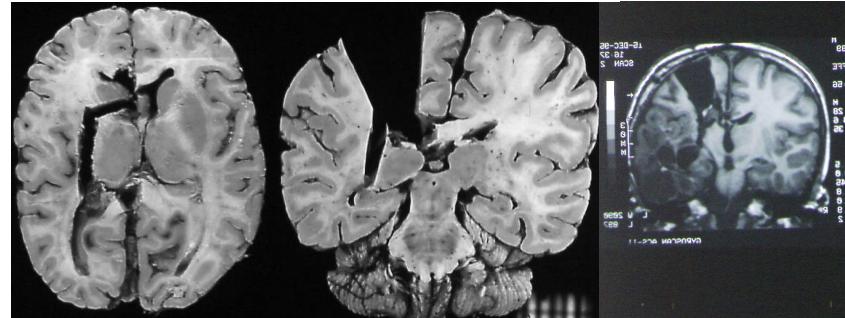
=> EEG « nettoyé »

Déconnexion: Parenchyme malade reste en place

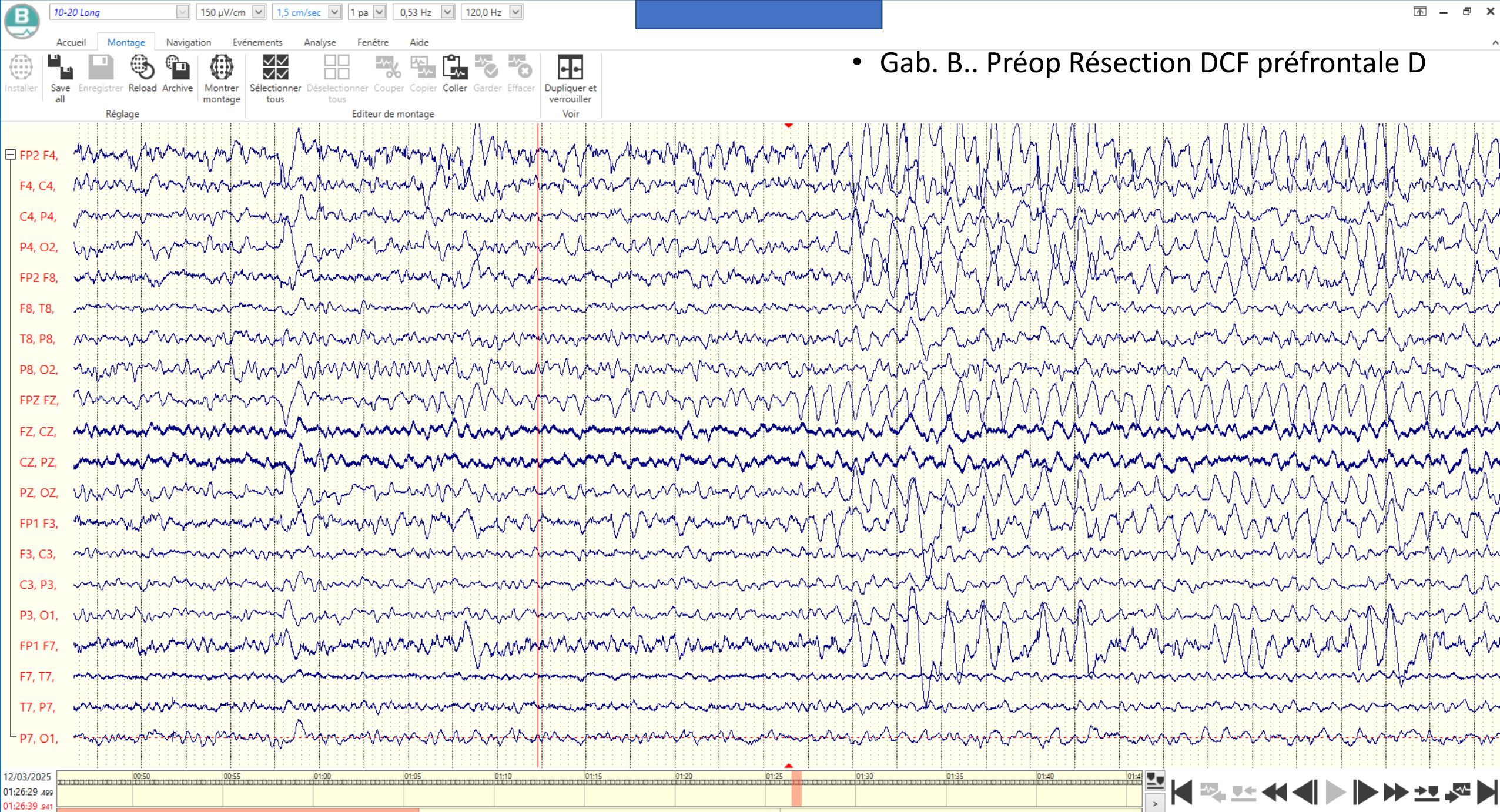
Déconnexion TPO

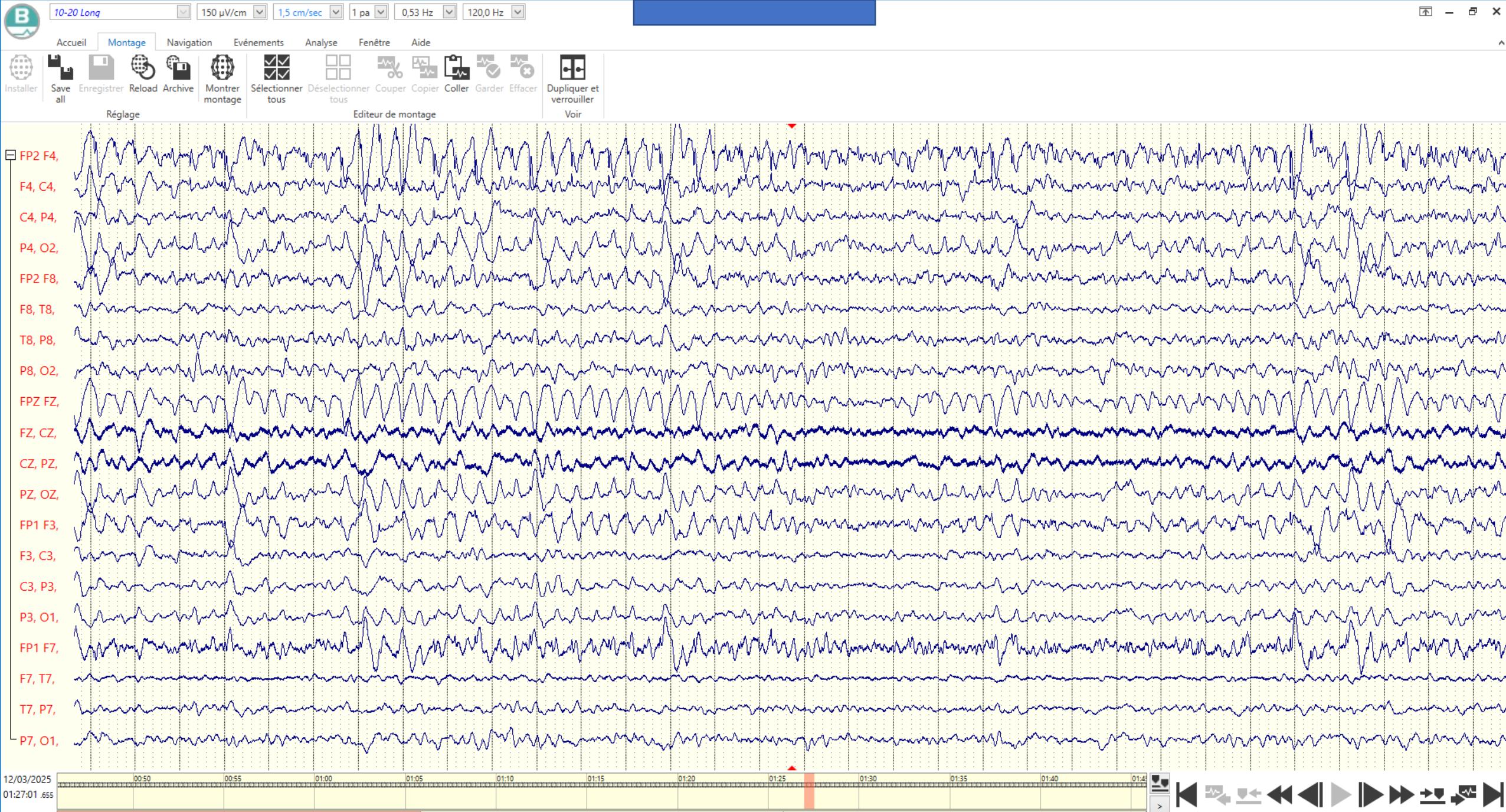


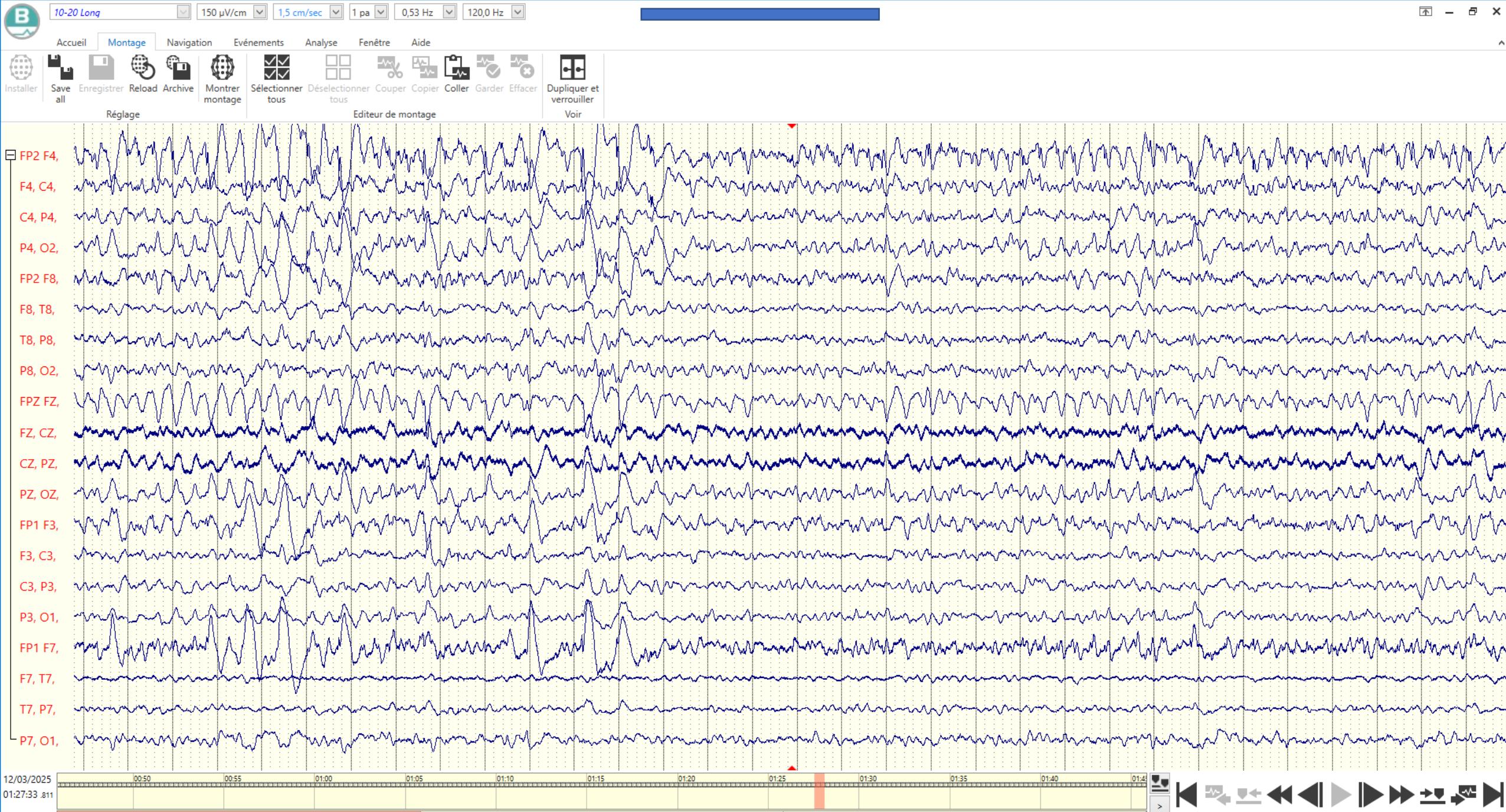
Hémisphérotomie
(Hémisphérectomie)

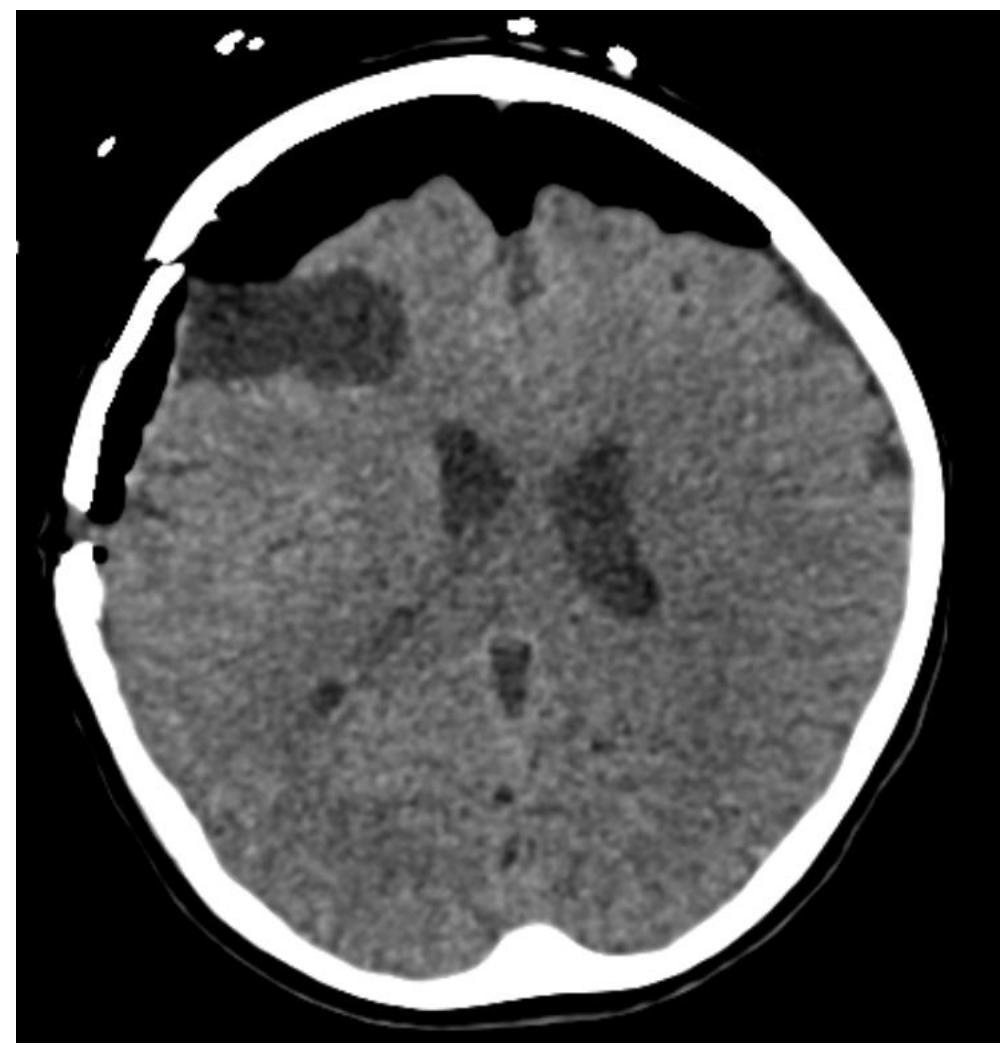
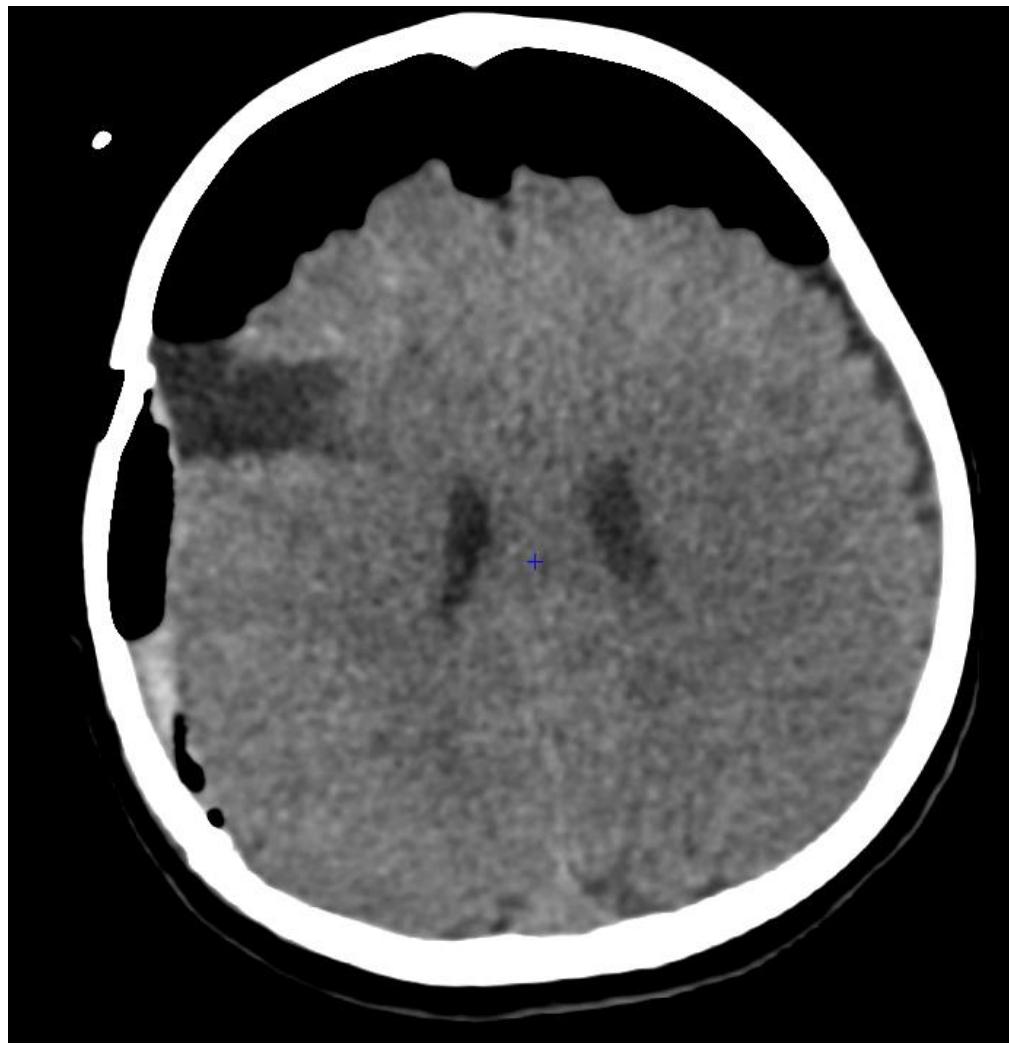


=> EEG « confiné »

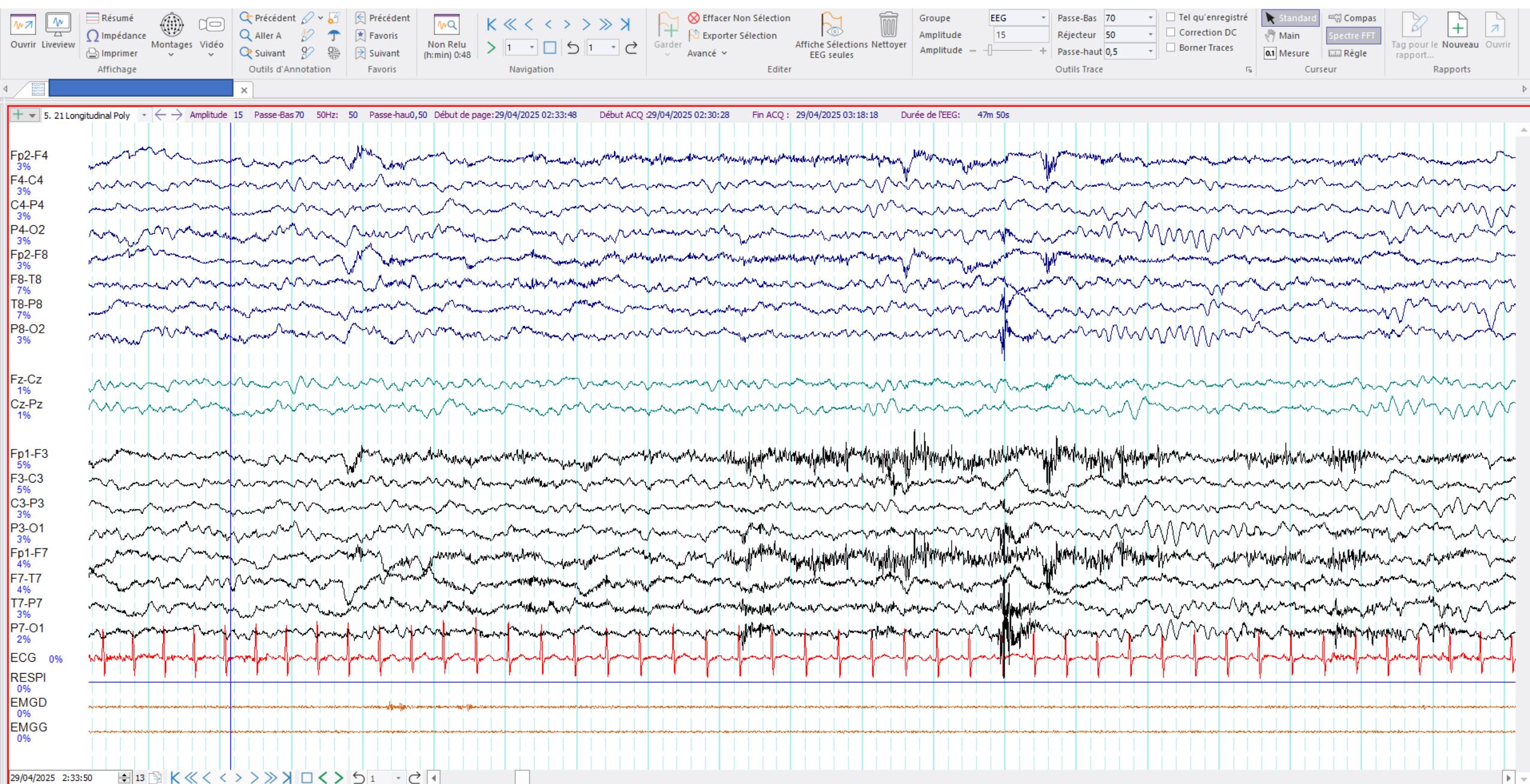




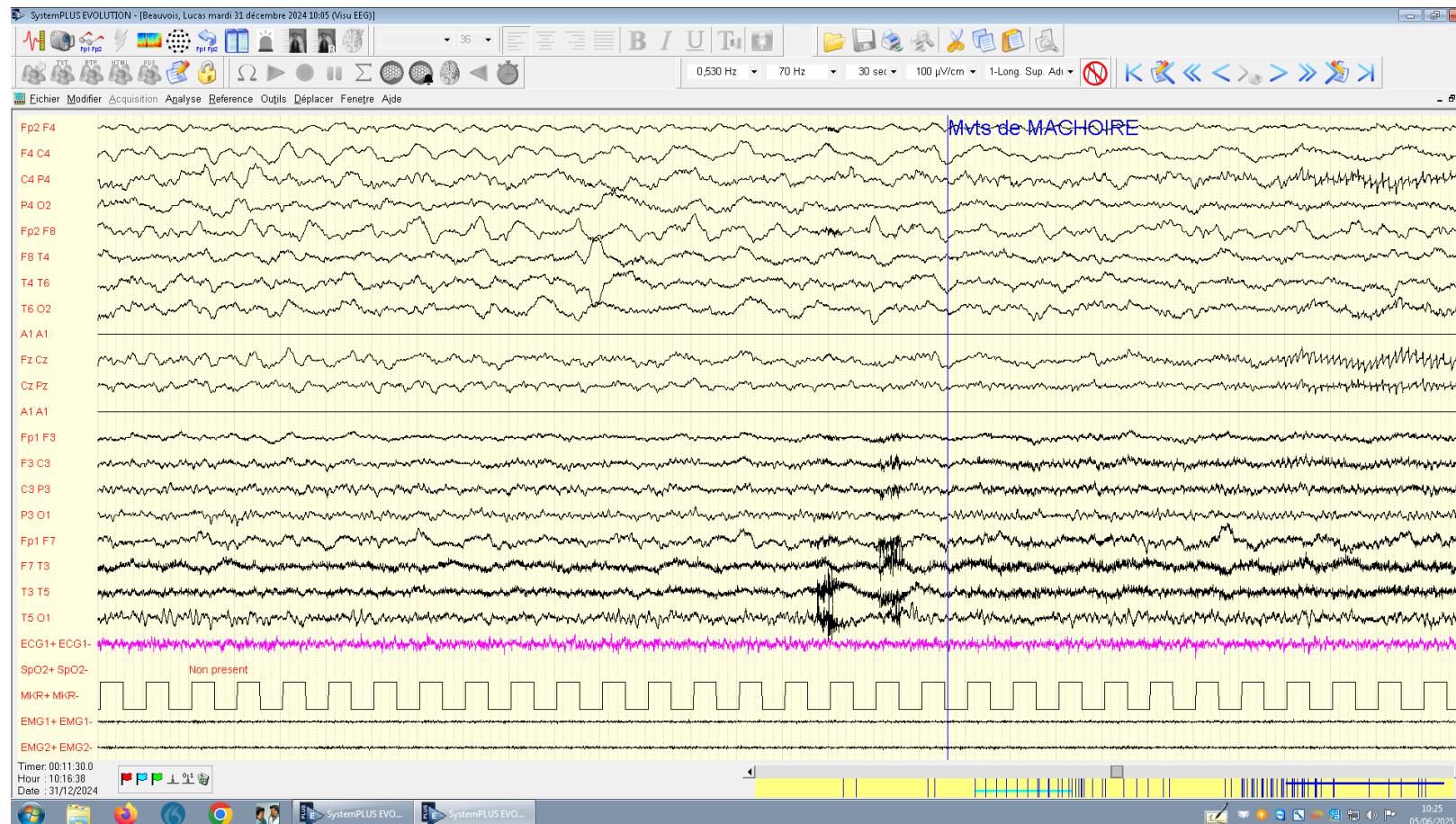


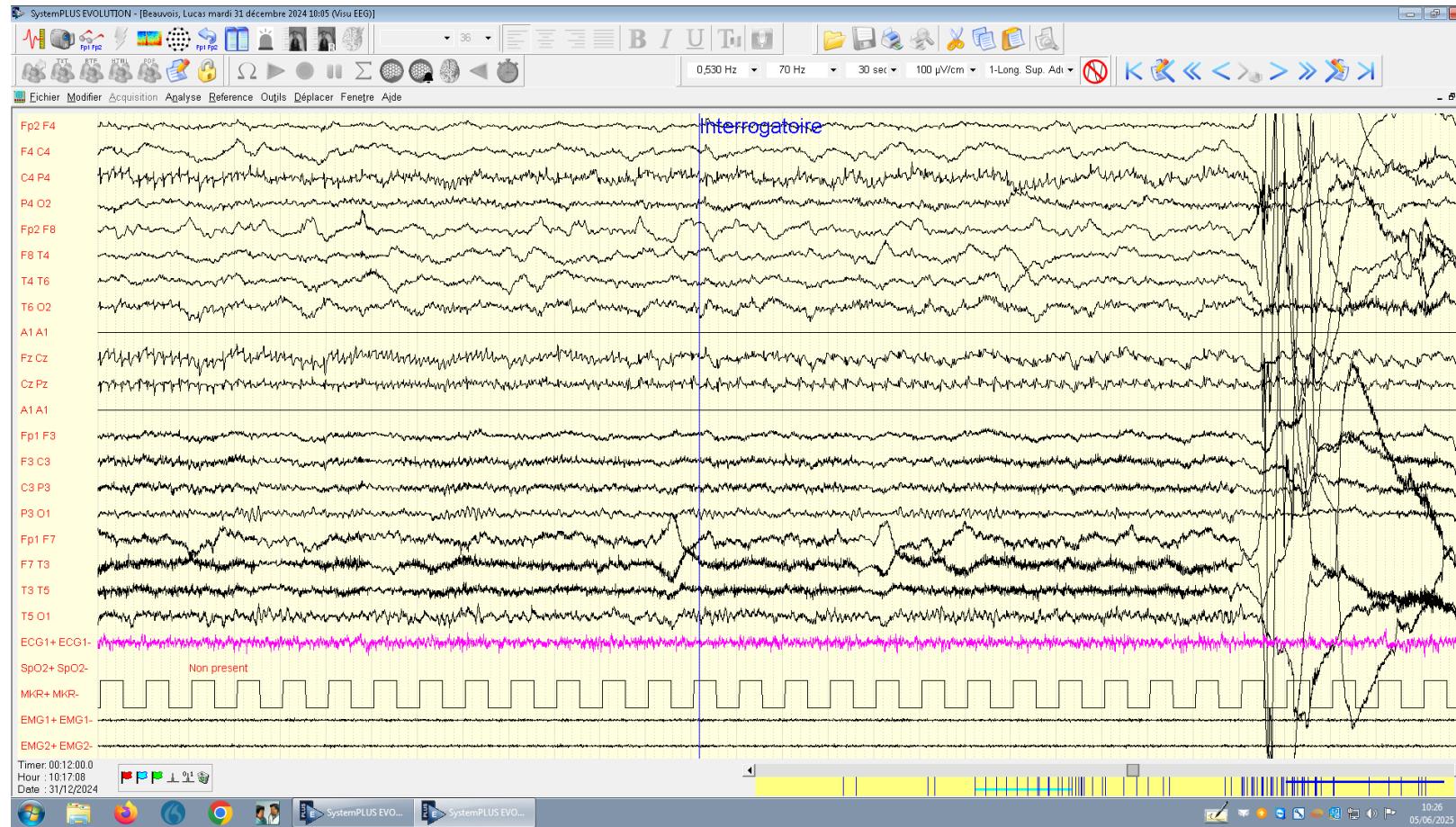


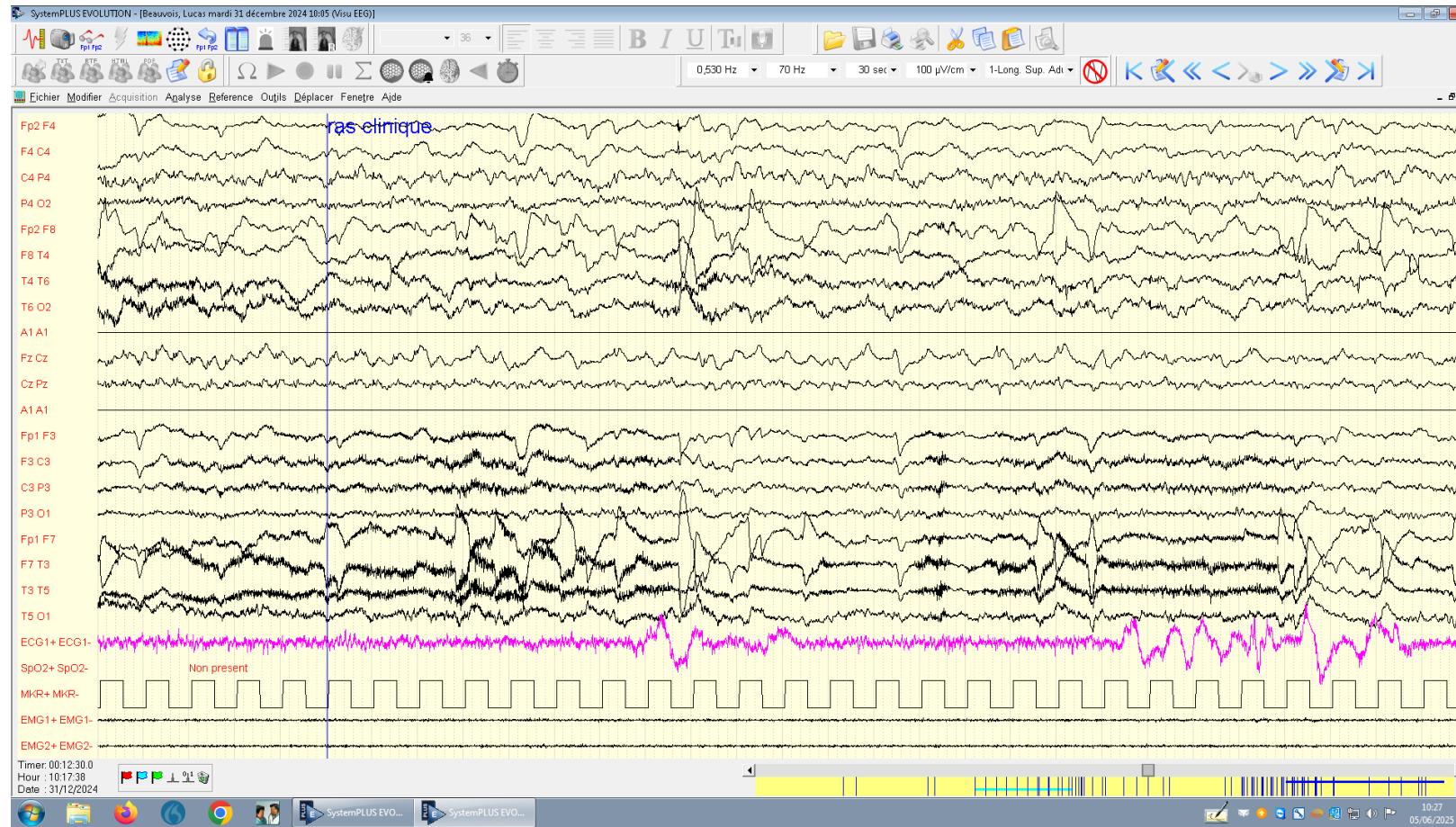
Gab.. B 3a, postopératoire résection préfrontale droite épargnant la motricité

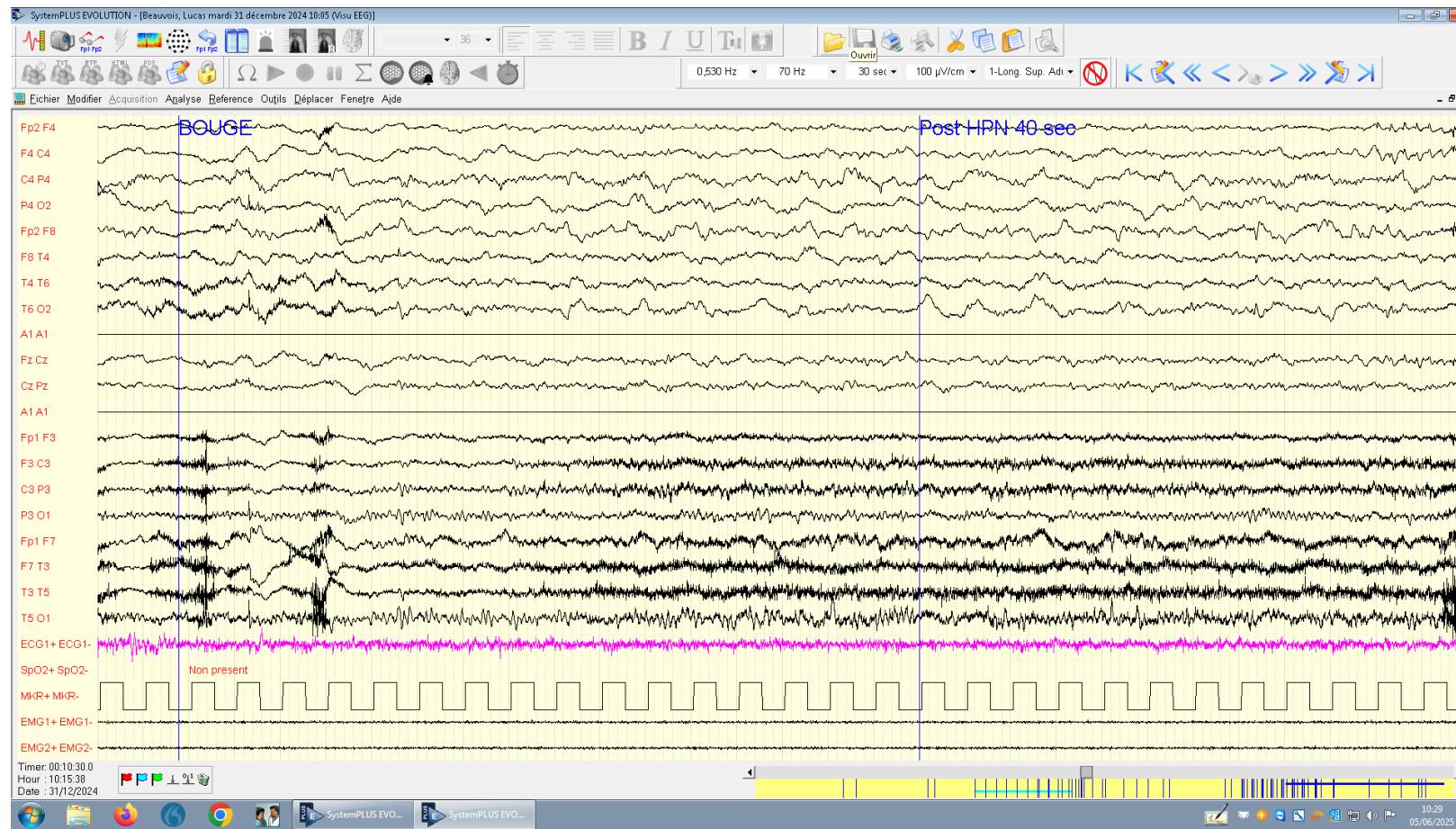


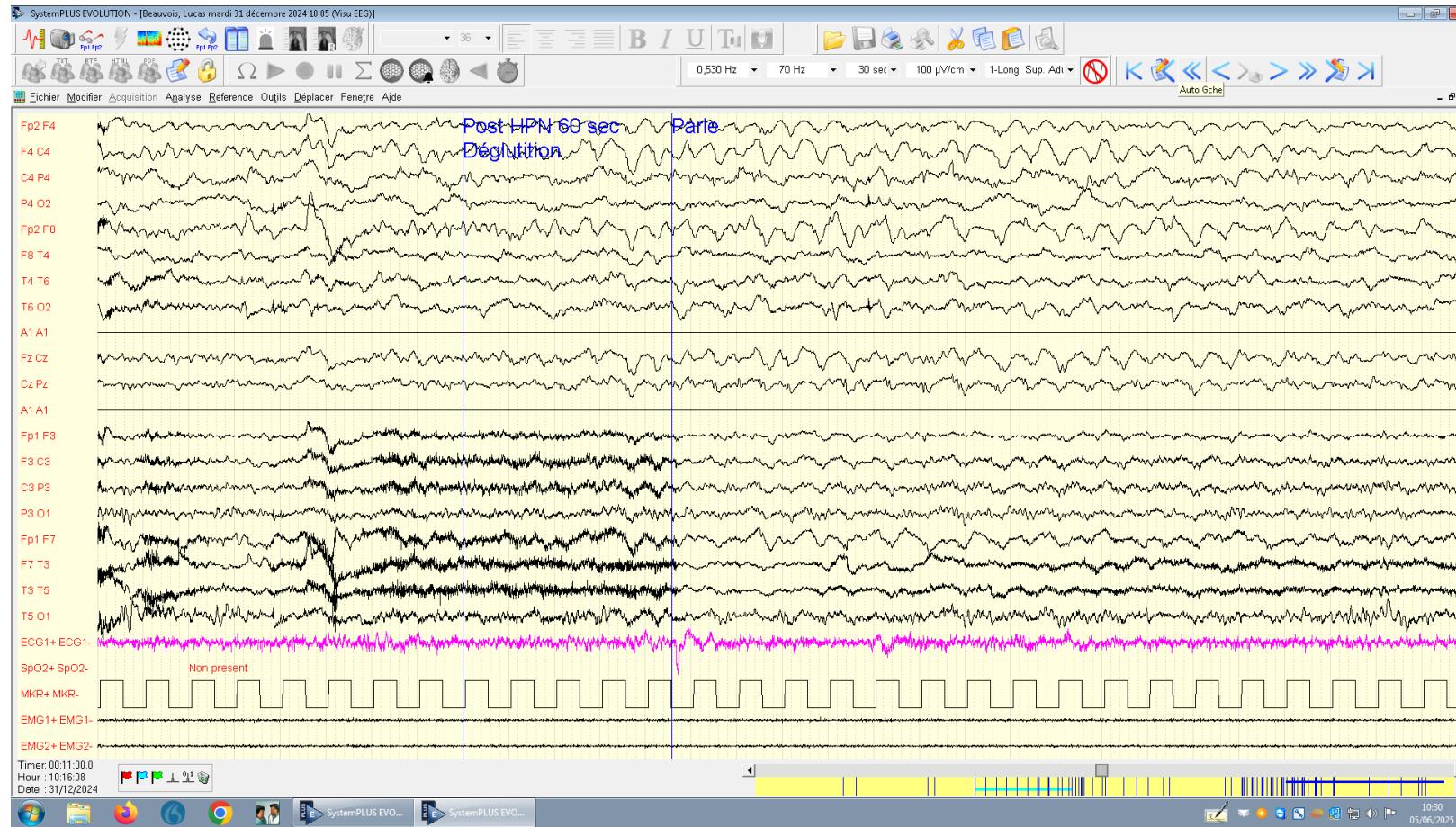
B..L.. Rasmussen droit post-hémisphérotomie





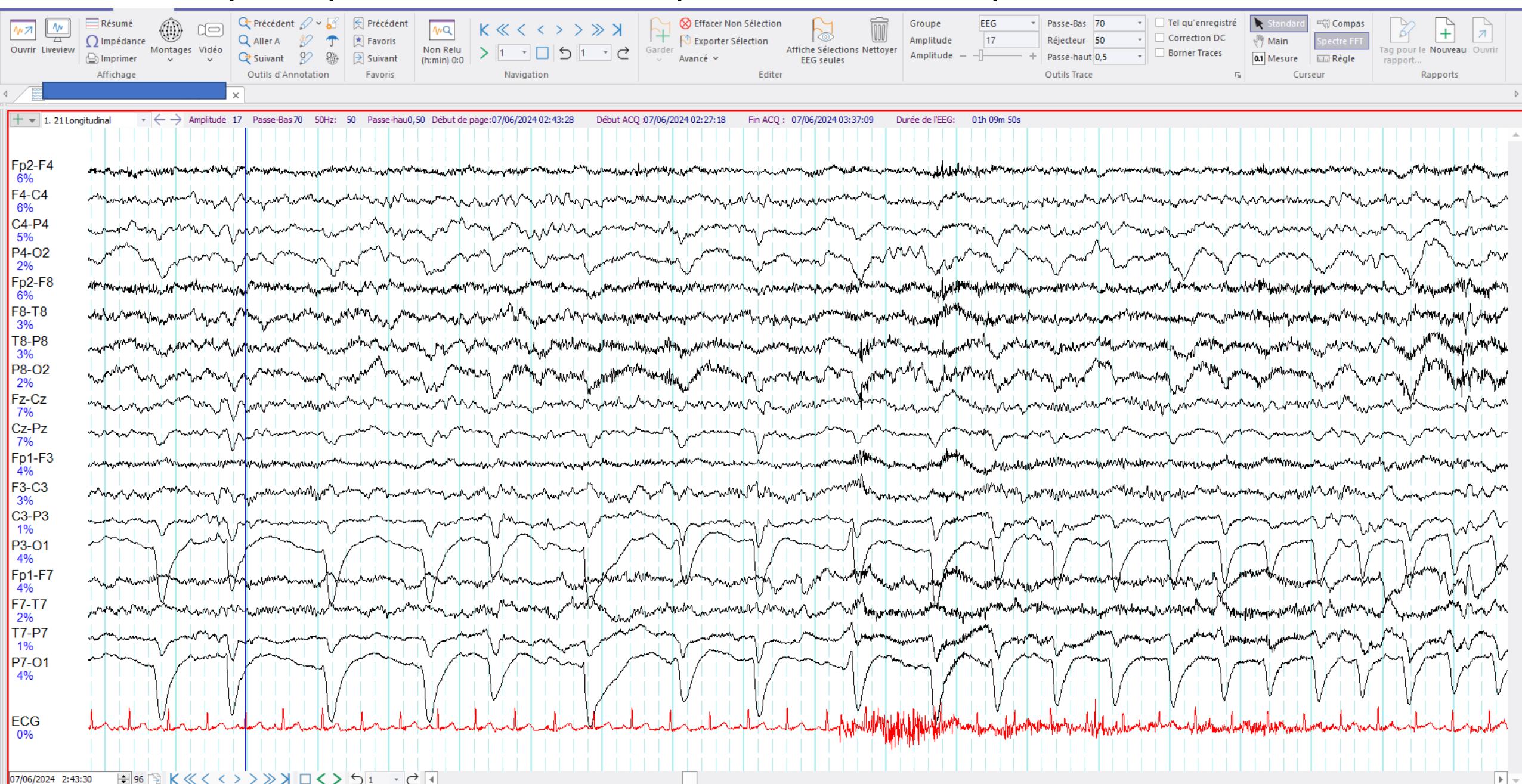


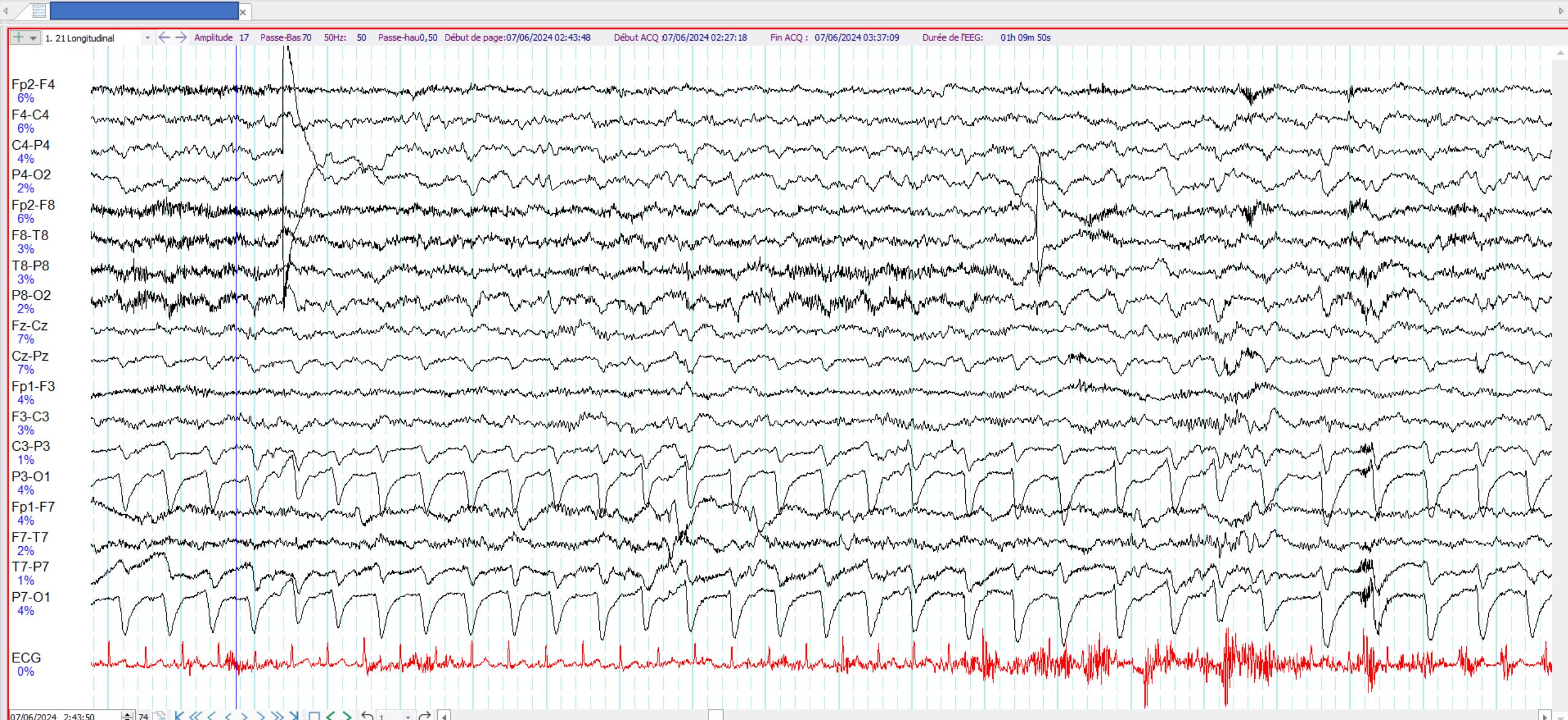


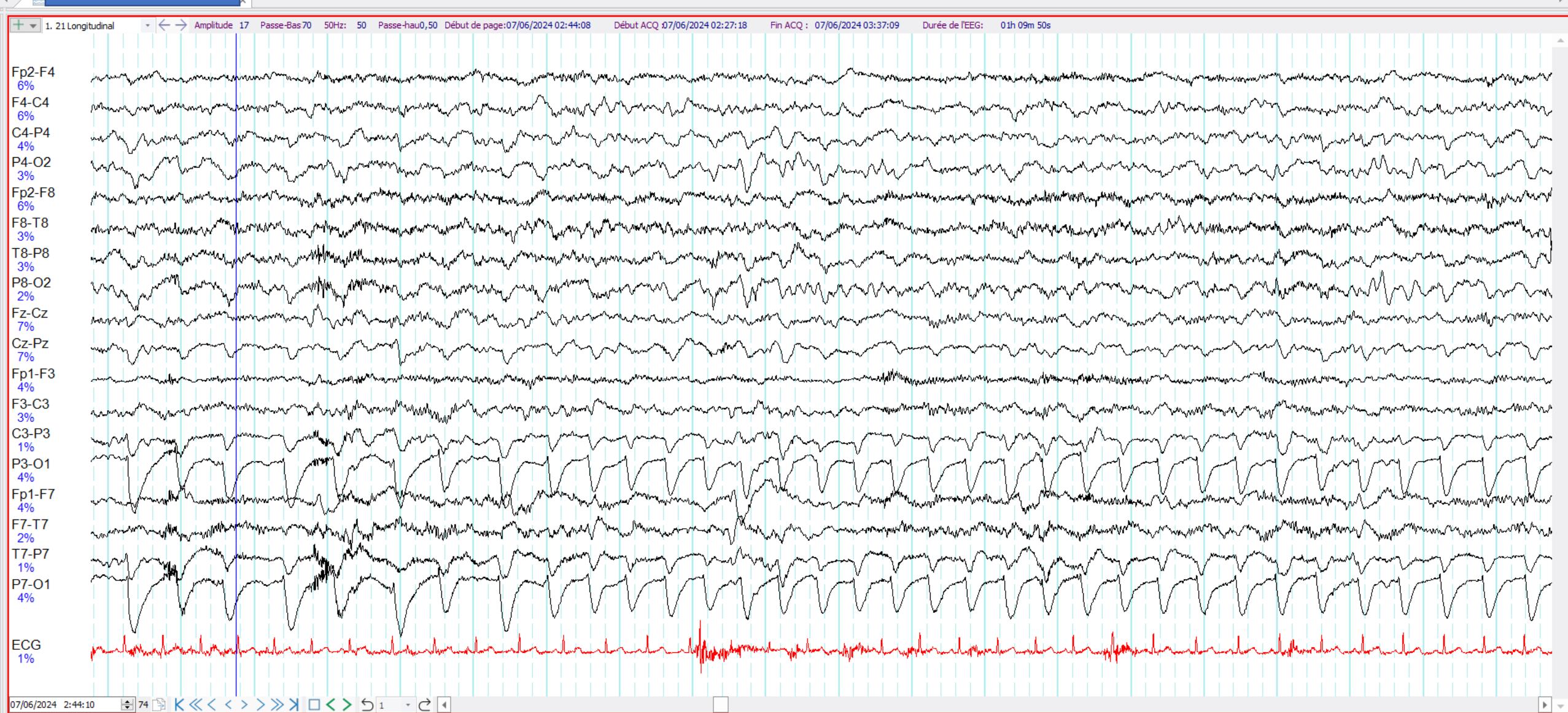
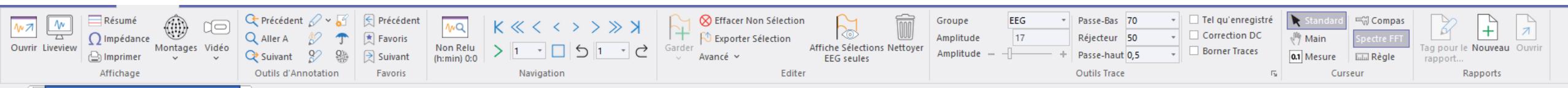


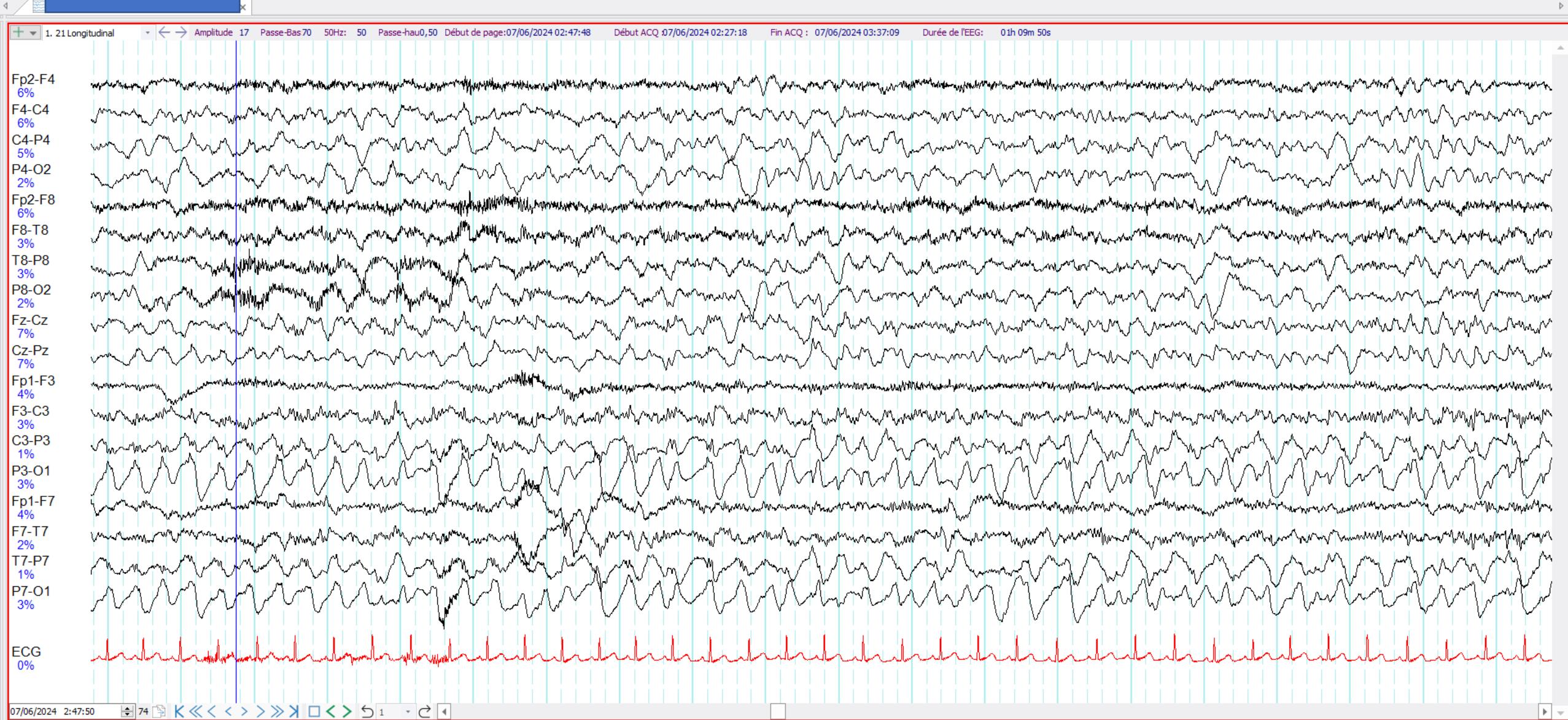
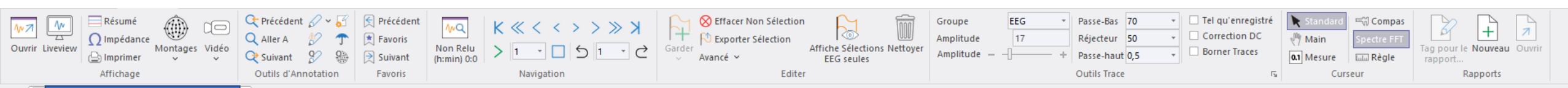
Parfois plusieurs temps opératoires nécessaires

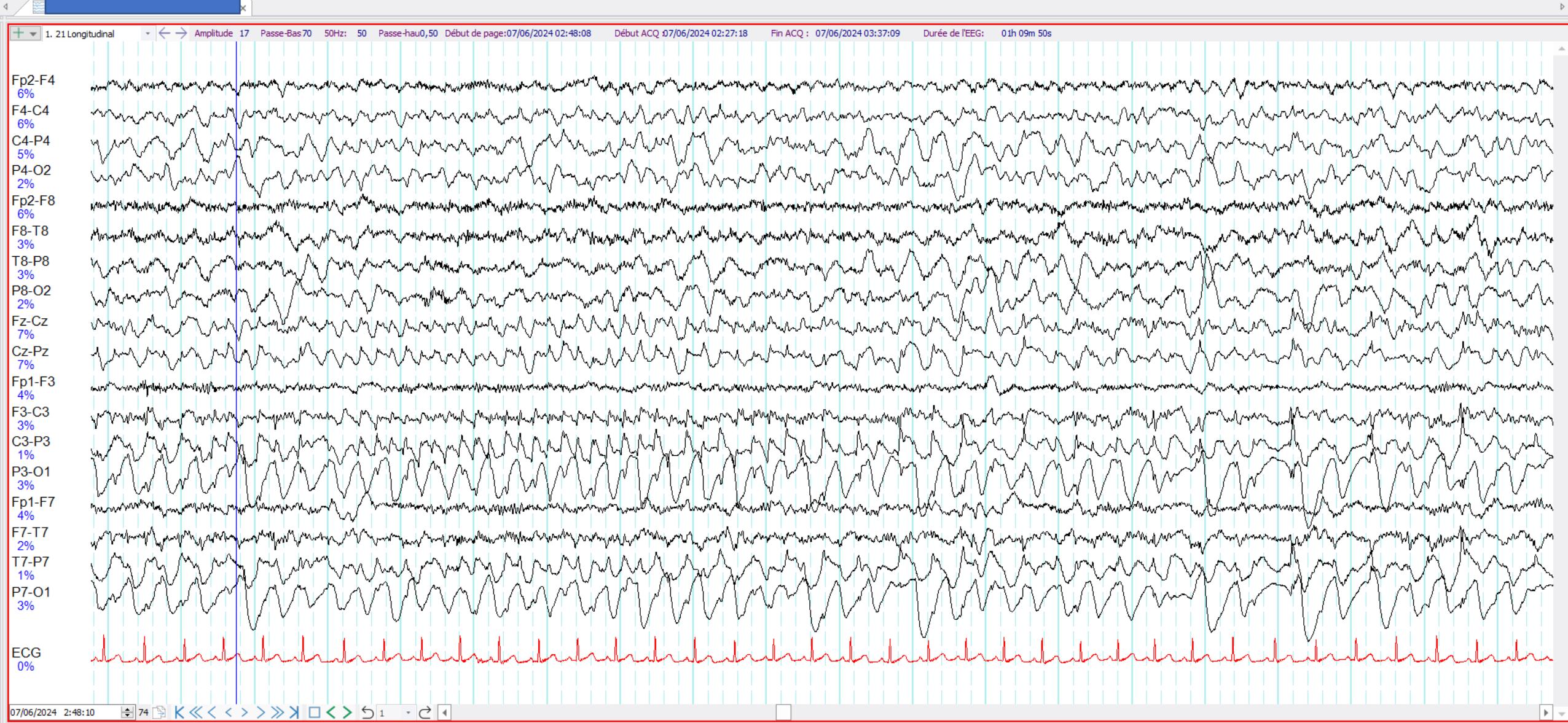
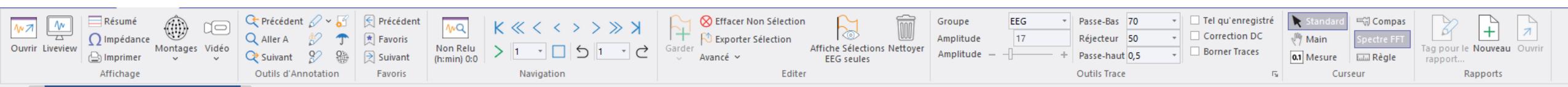
• LE.. L.. : postop Déconnexion Temporo-Pariéto-Occipitale G

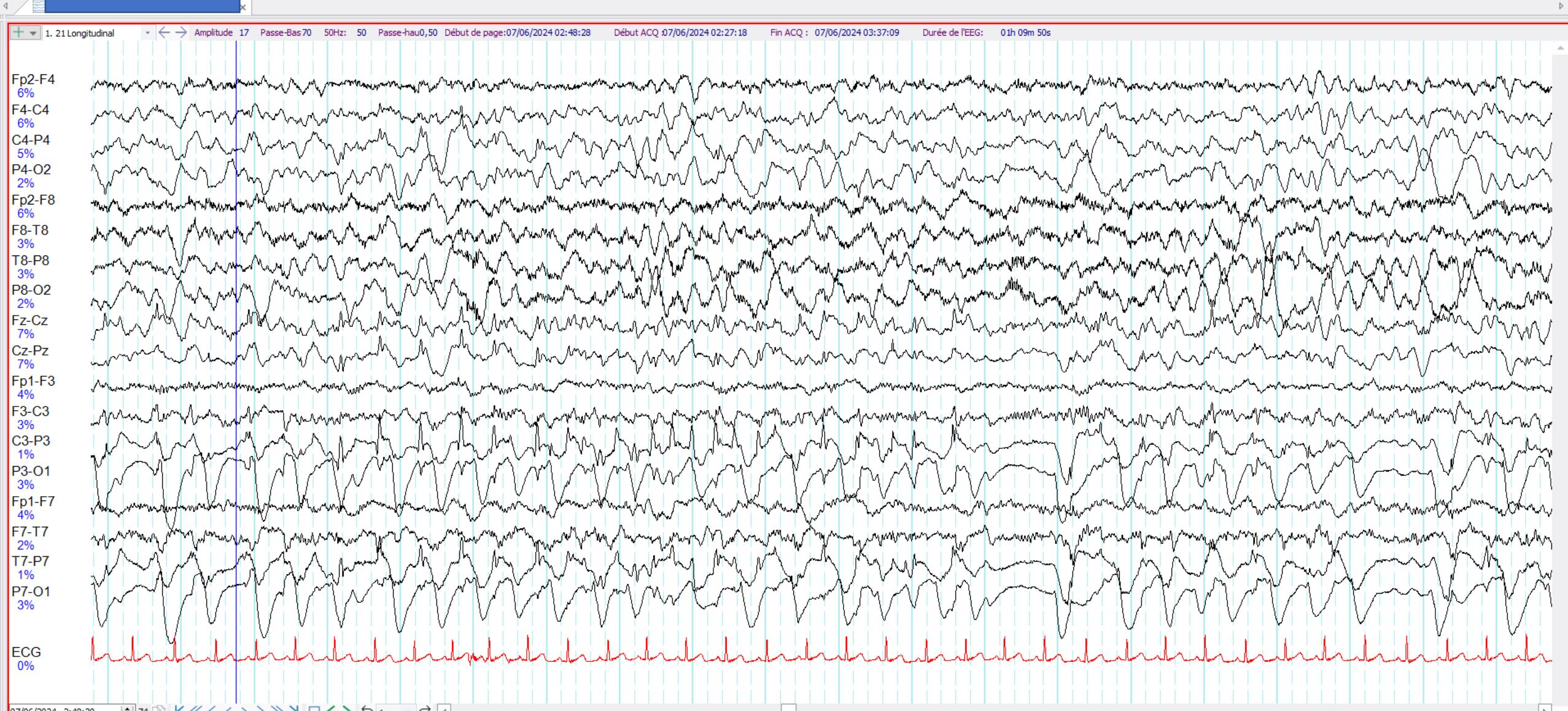
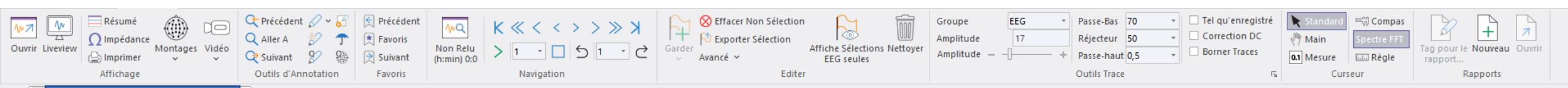


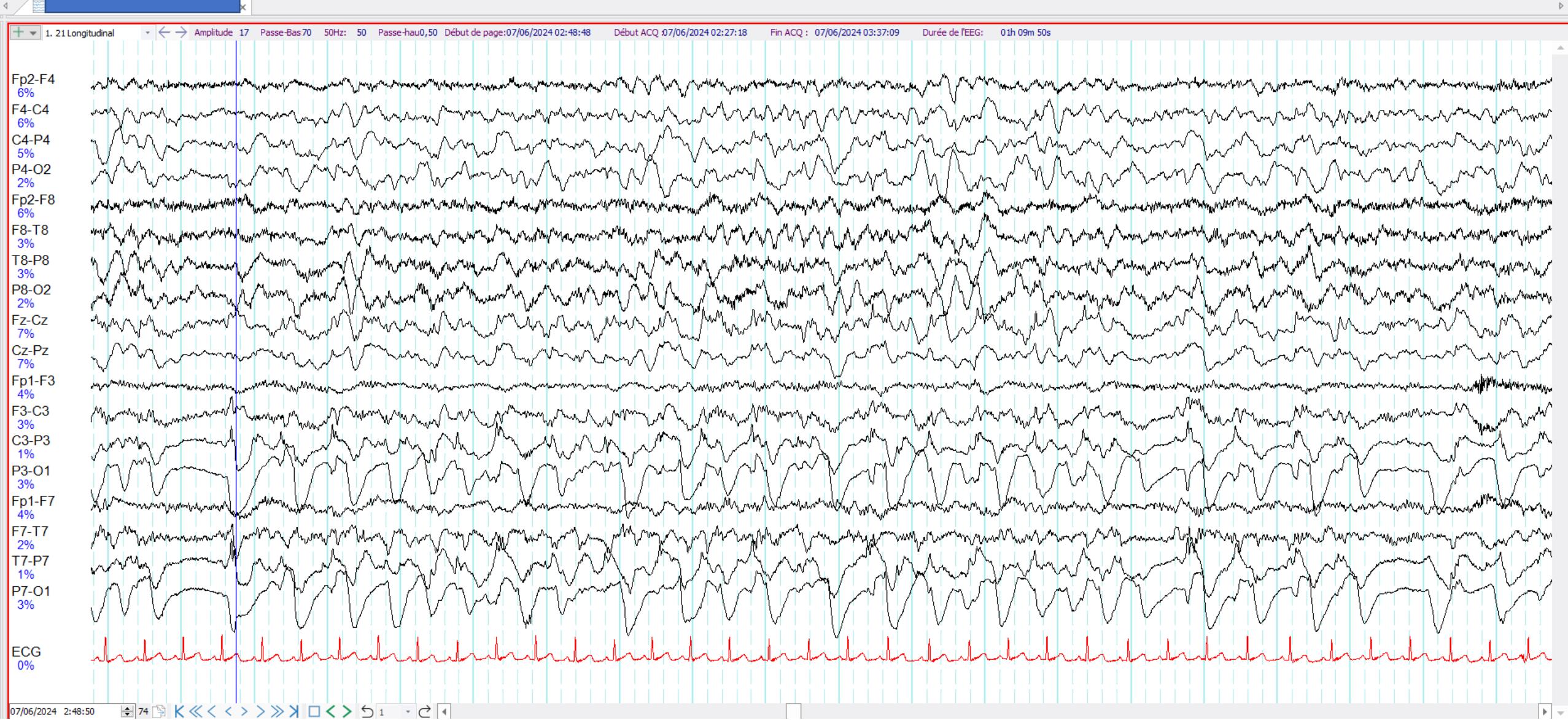
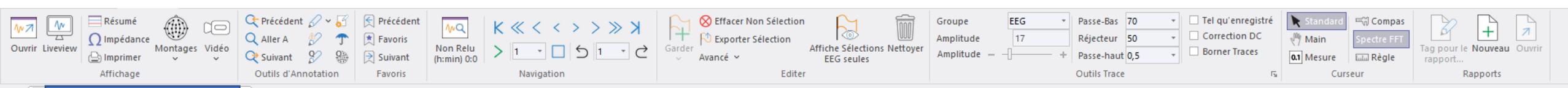




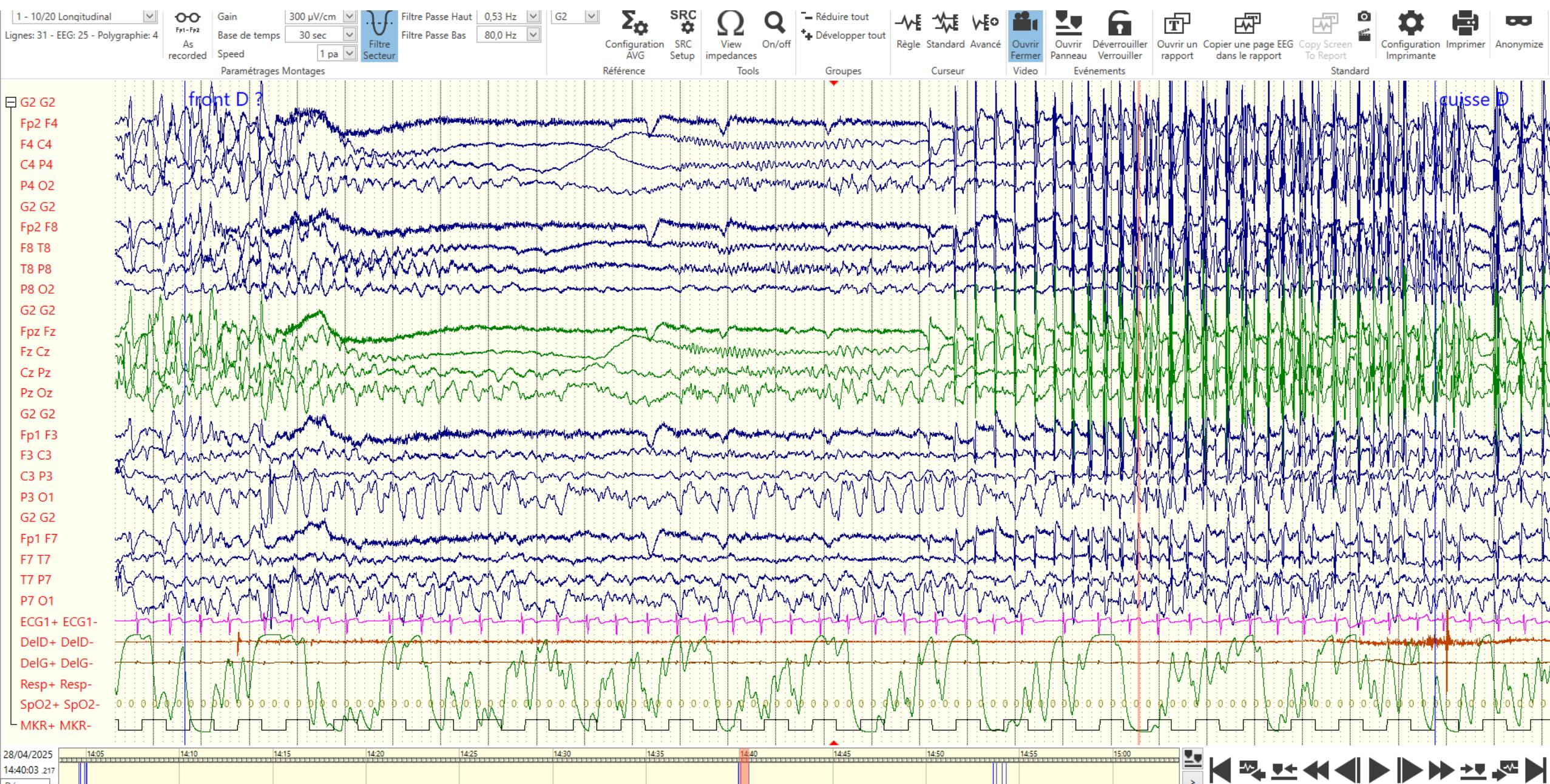






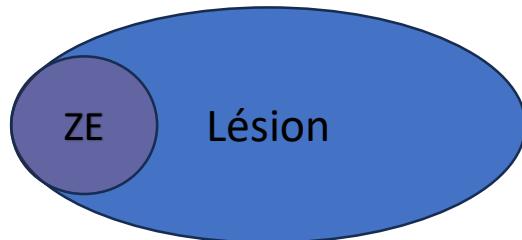


AGB..Ka... HME droite opérée 2x hémisphérotomie puis callosotomie à l'étranger : fx de SB par le trajet chir à partir de la commissure antérieure vers le Cx orbitofrontal droit

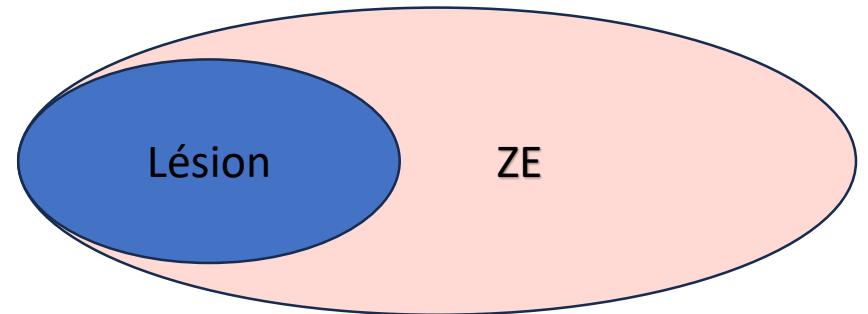


Rapports entre lésion, zone épileptogène et zone fonctionnelle

ZE= zone nécessaire et suffisante à retirer pour guérir les crises



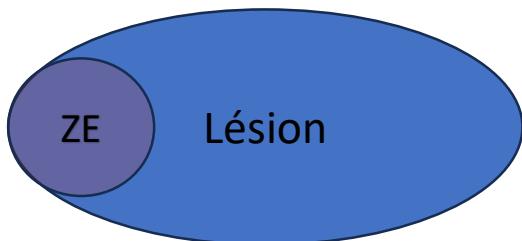
Polymicrogyrie



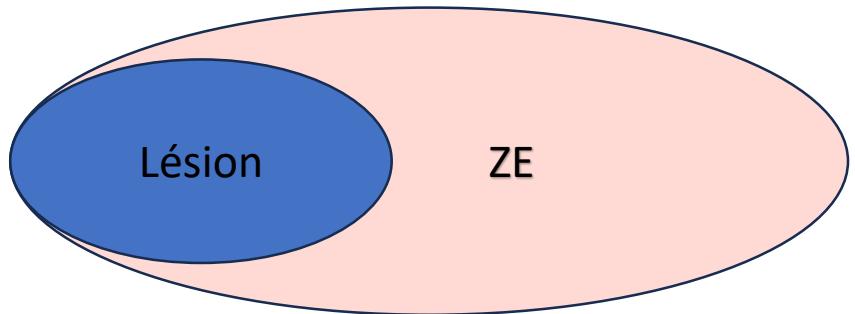
DCF, Tuber, tumeur ...

Rapports entre lésion, zone épileptogène et zone fonctionnelle

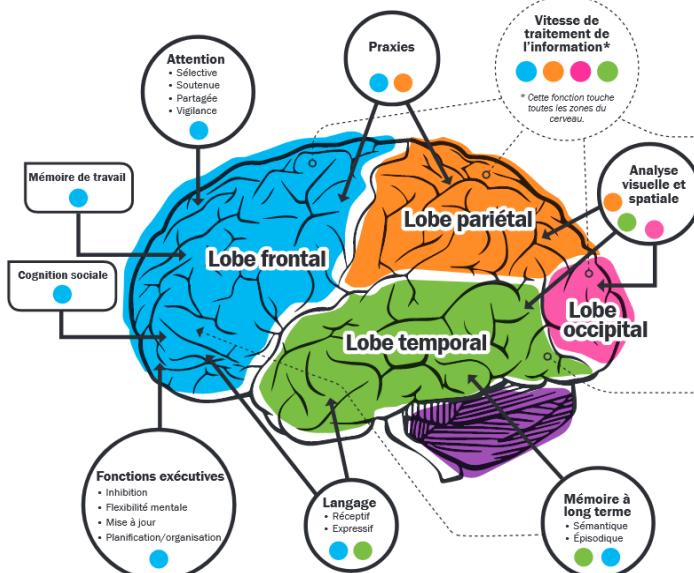
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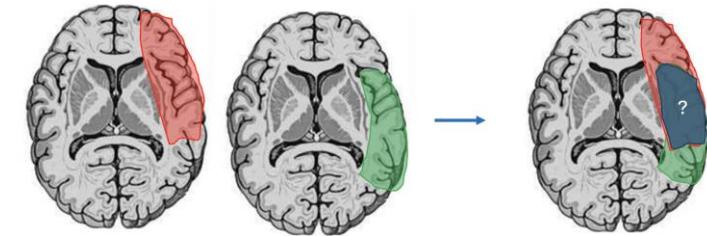
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Stéréoencéphalographie : SEEG avant exérèse

Indications:

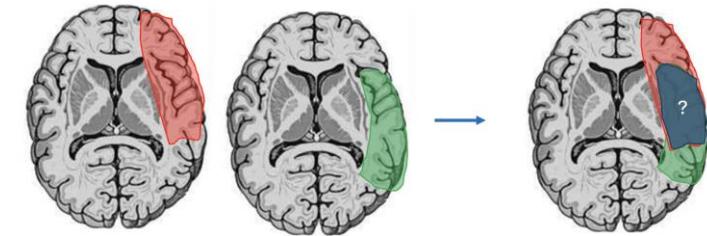
- Dès 18mois (épaisseur os temporal >2mm)
- Limites de ZE incertaines :
 - Discordance électro-clinico-radiologique
 - Lésion et ZE non strictement superposables
 - Déliminer la zone épileptogène
- ZE en région fonctionnelle :
 - Stimulations corticales: cartographie lésionnelle/fonctionnelle
 - Optimiser l'épargne fonctionnel en cas d'overlap
- +/- Thermocoagulations à visée pronostique/ thérapeutique-palliative



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Epilepsia



Research Article

Prognostic Value of Stereoelectroencephalography-Guided Radiofrequency Thermocoagulations in Childhood Drug-Resistant Epilepsies: A 10-year, 124-Case Prospective Cohort study

Checri et al. 2025, Submitted

Stereoelectroencephalography and Surgical Outcome in Polymicrogyria-Related Epilepsy: A Multicentric Study

Louis Georges Maillard,^{1,2,3} Laura Tassi,⁴ Fabrice Bartolomei,^{5,6}

Hélène Catenoix ,⁷ François Dubeau,⁸ William Szurhaj,^{9,10}

Philippe Kahane,^{11,12,13} Anca Nica,^{14,15} Petr Marusic,¹⁶ Ioana Mindruta,^{17,18}

Francine Chassoux,¹⁹ and Georgia Ramantani ,^{1,20,21}

ANNALS of Neurology

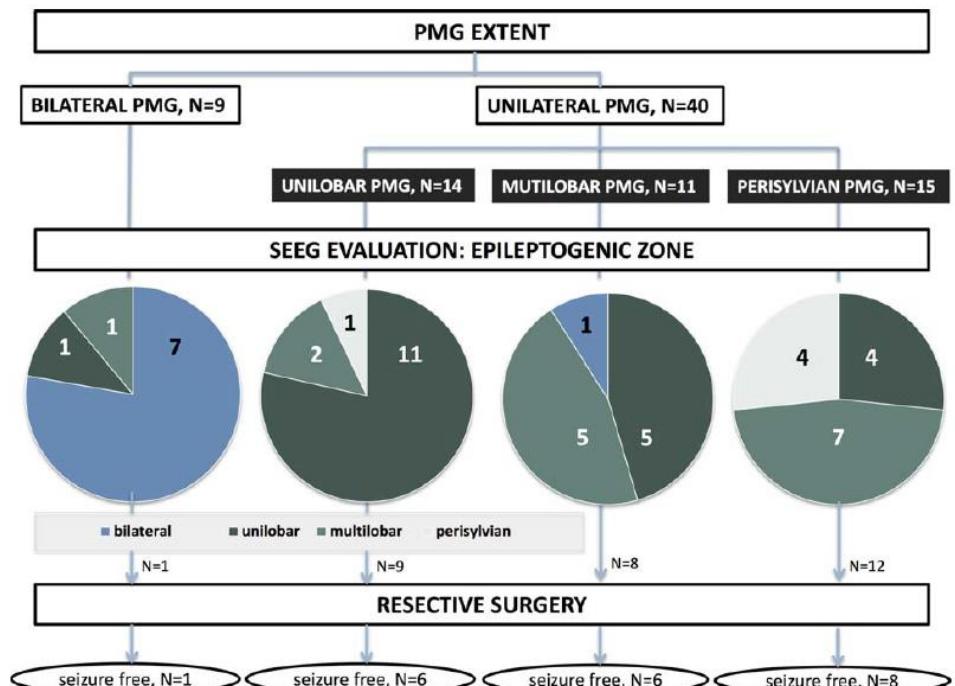
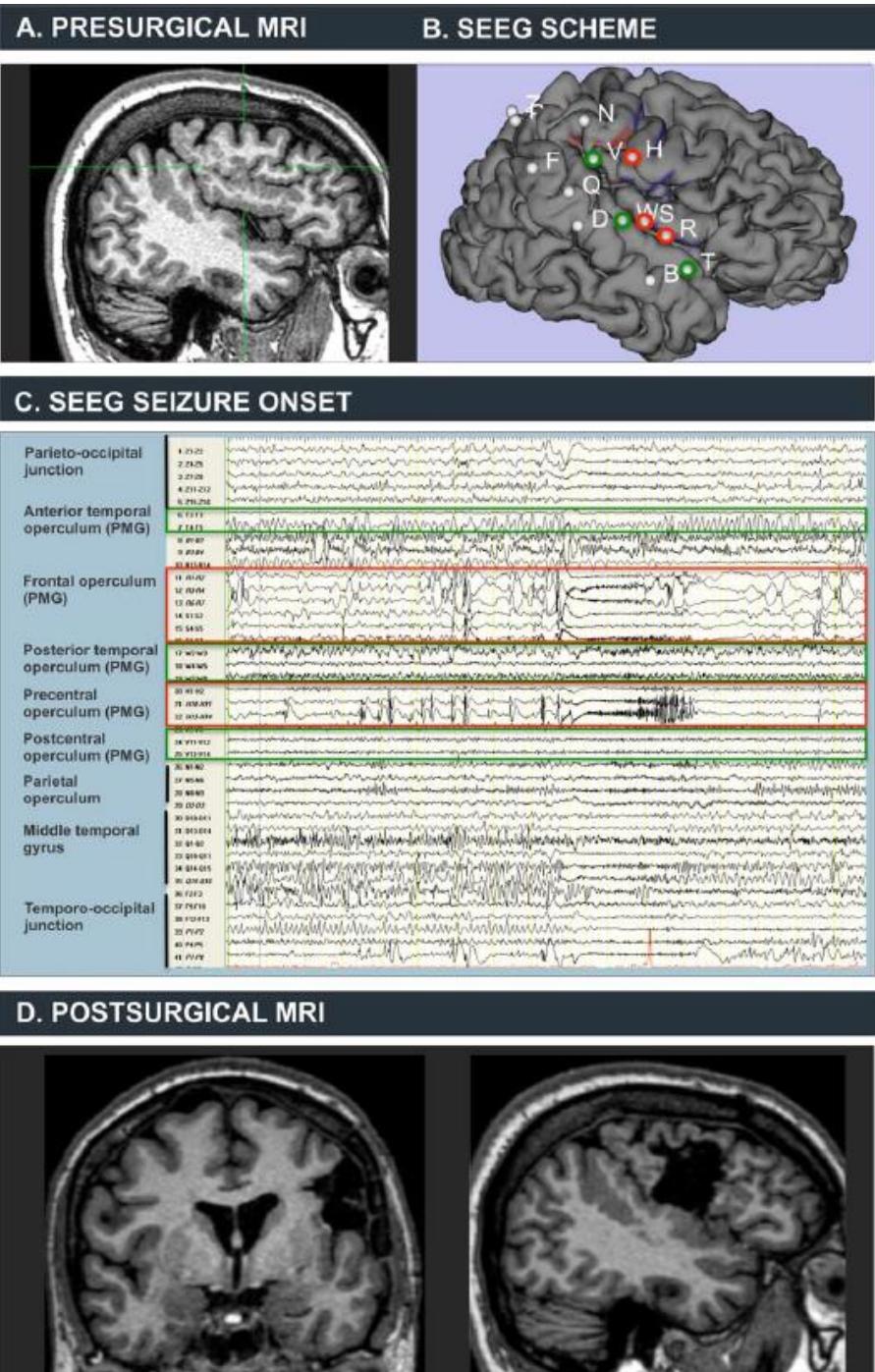
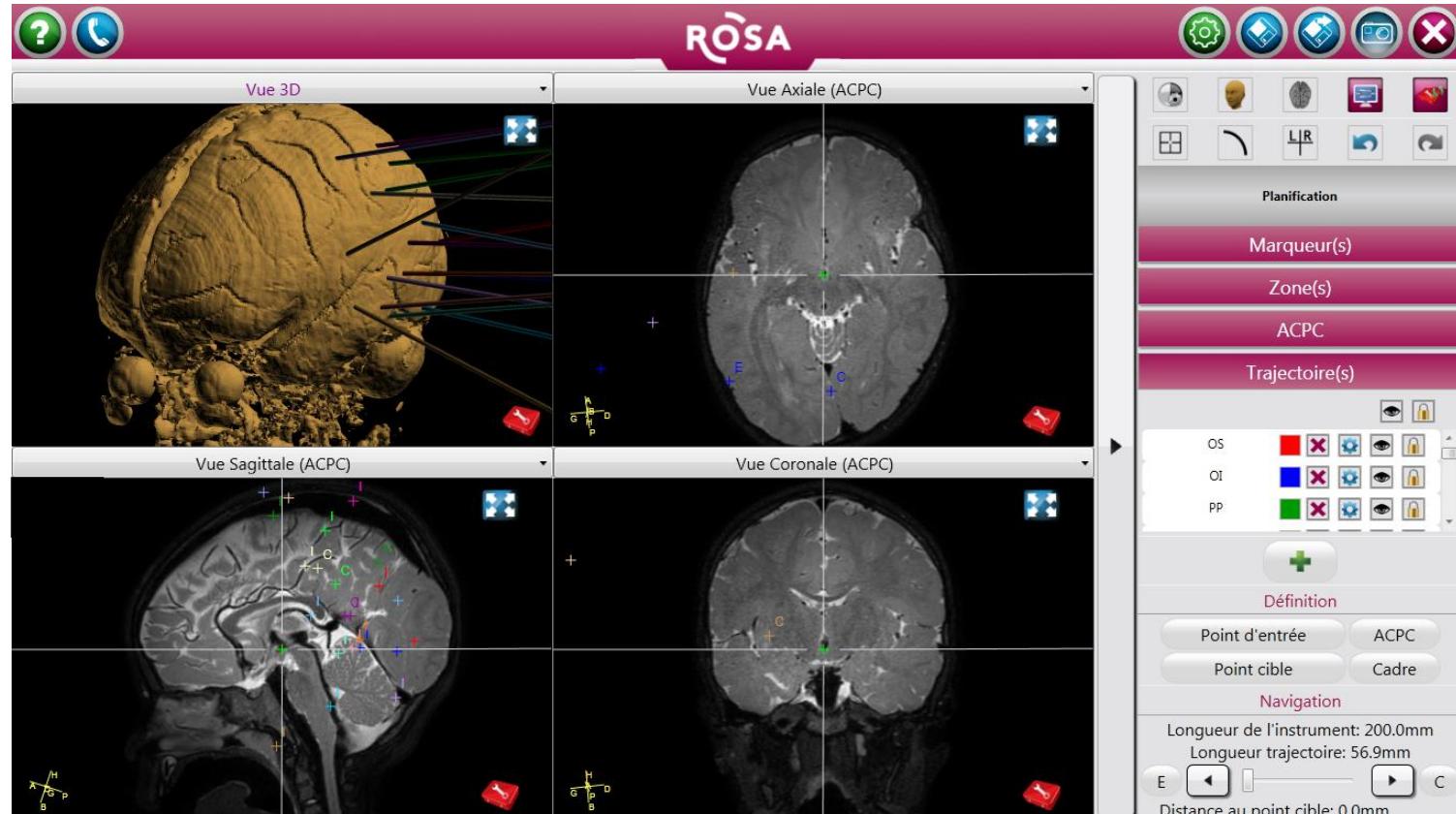


FIGURE 1: Flow chart illustrating the findings of stereoelectroencephalography (SEEG) evaluation according to the extent of the polymicrogyria (PMG), including the extent of the epileptogenic zone and the outcome of epilepsy surgery, where applicable. [Color figure can be viewed at www.annalsofneurology.org]



Préopératoire: Planification des trajectoires

- Scanner cérébral (laser registration)
- IRM 3D: 3DT2 and 3DT1 gado



Procédure chirurgicale

Robotic assisted Stereotactic
Frameless technique



Laser registration



Bone thickness > 2 mm
(approx 1,5 y.o)



Enregistrement 7-14jours





Review

Invasive evaluation in children (SEEG vs subdural grids)

Delphine Taussig*, Mathilde Chipaux, Martine Fohlen, Nathalie Dorison, Olivier Bekaert,
Sarah Ferrand-Sorbets, Georg Dorfmüller

Service de neurochirurgie pédiatrique, Fondation Rothschild 25-29, rue Maréchal Paris Cedex 19, France



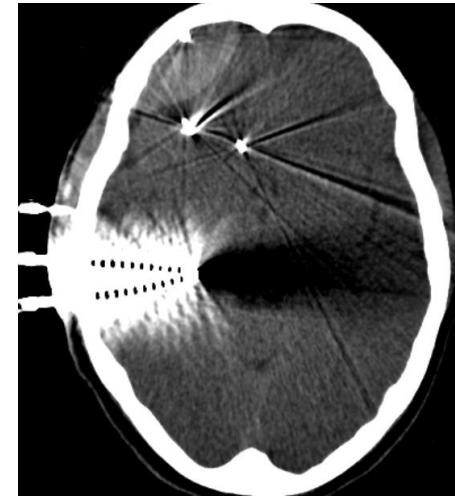
Complications rares N= 406 SEEG

- 2 Infections locales
- 3 Hématomes intraparenchymateux <1cm (non chirurgicaux)
- 2 Embases enfoncées
- 2 Ruptures électrodes
- 2 HED - évacuation
- 2 HSD (no surgery)
- 2 HSA



Complication rate: 3,5%

In line with literature



Aucune séquelle

LEAT « Low-grade Epilepsy-Associated brain Tumors »

36 centres européens : EEBB European Epilepsy Brain Bank

Tous les patients opérés entre 1990 – 2014: 9 523 patients

Tumeurs = Gangliogliome & DNET (Dysembryoplastic NeuroEpithelial Tumour)

2^{ème} cause d'épilepsie : Adultes (22,2%) et Pédiatrique (27,2%)

Table 2. Summary of the 10 Most Common Histopathological Diagnoses among 9523 Patients Who Underwent Epilepsy Surgery.*						
Diagnosis	Category	Patients with Condition (N=9523) no. (%)	Age at Onset of Seizures	Duration of Epilepsy	Localization† lobe	%
Hippocampal sclerosis	Hippocampal sclerosis	3463 (36.4)	11.3±10.1	22.5±12.7	Temporal	100.0
Ganglioglioma	Tumor	986 (10.4)	12.1±10.3	11.4±10.4	Temporal	82.5
Focal cortical dysplasia type II	Malformation of cortical development	859 (9.0)	5.6±6.9	14.0±11.7	Frontal	51.6
No lesion	No lesion	738 (7.7)	13.0±10.6	15.4±10.6	Temporal	67.7
Dysembryoplastic neuroepithelial tumor	Tumor	565 (5.9)	14.0±10.9	12.0±10.7	Temporal	68.1
Glial scar	Glial scar	461 (4.8)	10.7±10.3	14.8±11.1	Temporal	37.1
Cavernous angioma	Vascular malformation	431 (4.5)	25.4±13.0	12.3±11.2	Temporal	74.7
Mild malformation of cortical development	Malformation of cortical development	279 (2.9)	9.6±10.0	13.7±11.5	Temporal	49.1
Focal cortical dysplasia type I	Malformation of cortical development	268 (2.8)	7.4±9.6	9.3±8.1	Temporal	35.1
Focal cortical dysplasia not otherwise specified	Malformation of cortical development	206 (2.2)	8.0±8.0	13.4±11.5	Temporal	45.1
Total		8256 (86.7)	11.6±10.8	17±12.6	Temporal	71.9

Blumcke, 2017



Article

Early Epilepsy Surgery in Benign Cerebral Tumors: Avoid Your 'Low-Grade' Becoming a 'Long-Term' Epilepsy-Associated Tumor

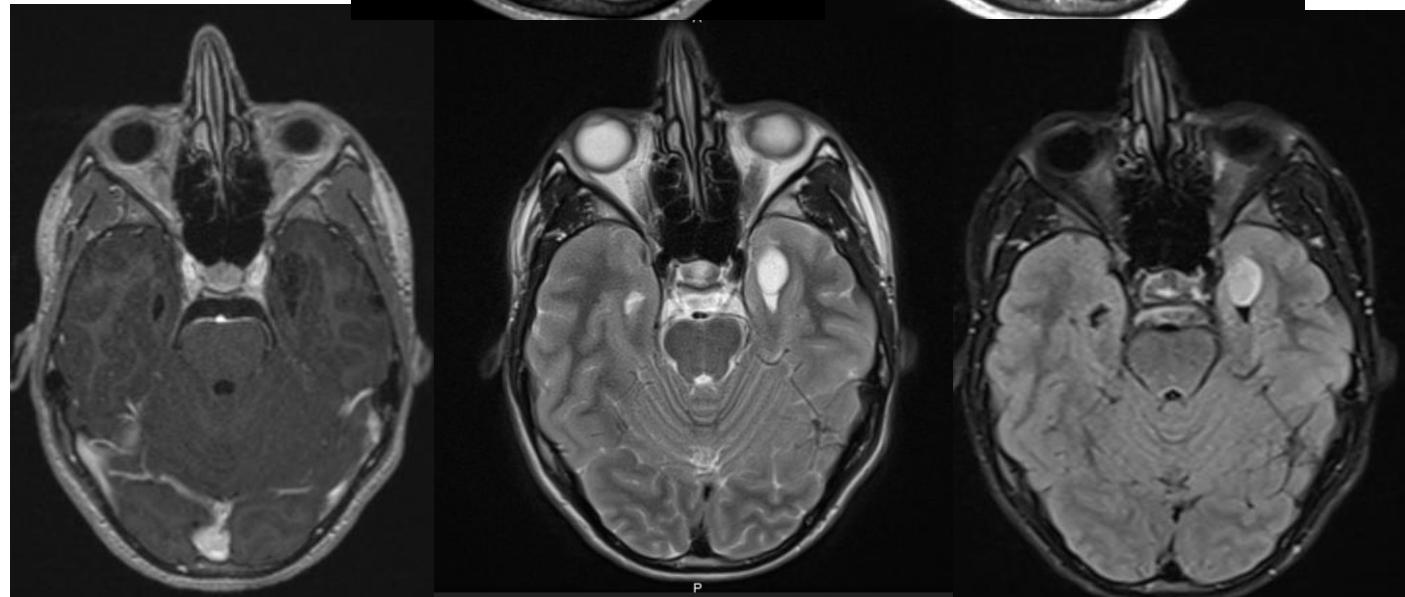
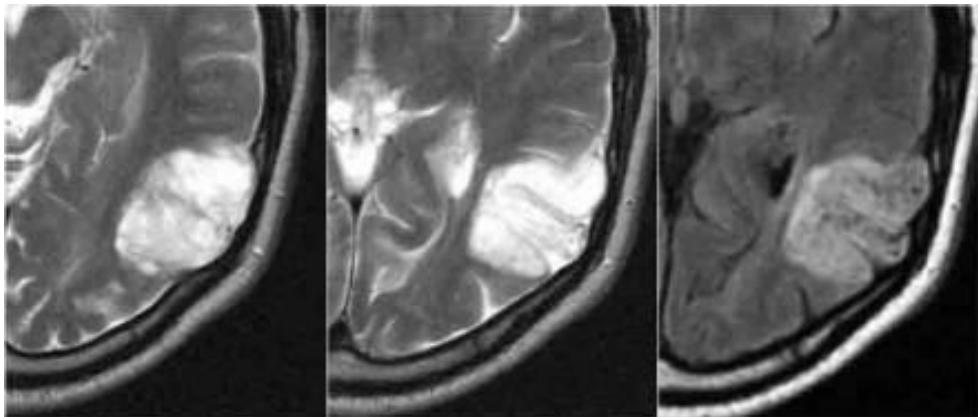
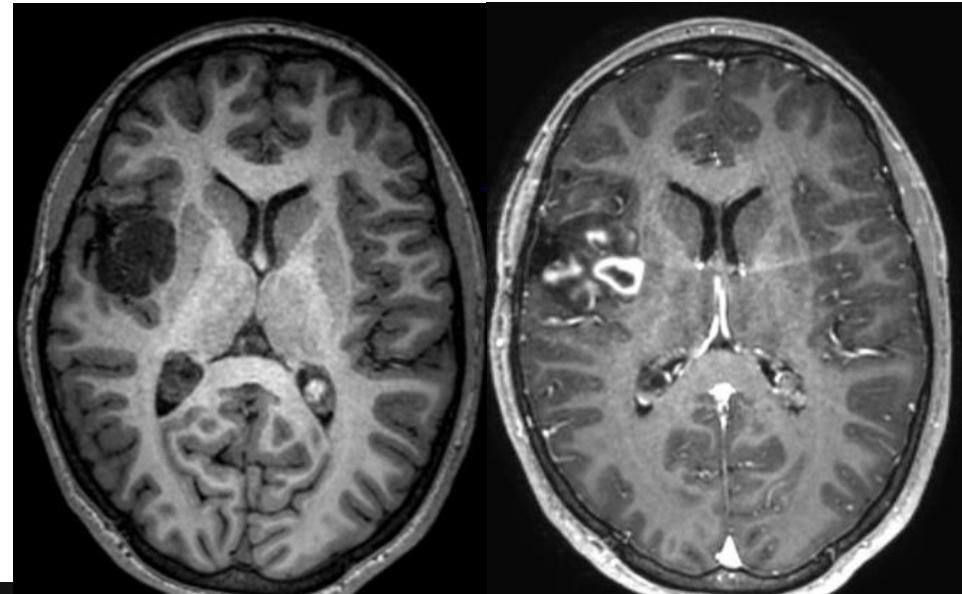
Catrin Mann ^{1,2,*}, Nadine Conradi ^{1,2}, Elisabeth Neuhaus ^{1,2,3}, Jürgen Konczalla ^{2,4}, Thomas M. Freiman ^{2,4,5}, Andrea Spyrantis ^{2,4}, Katharina Weber ^{6,7,8,9}, Patrick Harter ^{6,7,8,9}, Felix Rosenow ^{1,2}, Adam Strzelczyk ^{1,2} and Susanne Schubert-Bast ^{1,2,10}

- Epilepsy surgery in LEAT evaluated in drug-resistant cases = time delay to surgery?
- 35 patients , Frankfurt, Allemagne
- 4-40 ans (moy 18a)
- Chirurgie de l'épilepsie => 77% libres de crises
- Atteinte cognitive
 - Préopératoire chez 65.7%
 - Post-opératoire chez 51.4% (FdR: bilaéralisation des crises, onset jeune)

« LEAT should lead to early epilepsy surgery without requiring proof of drug resistance »

LEAT: DNET / gangliogliomes

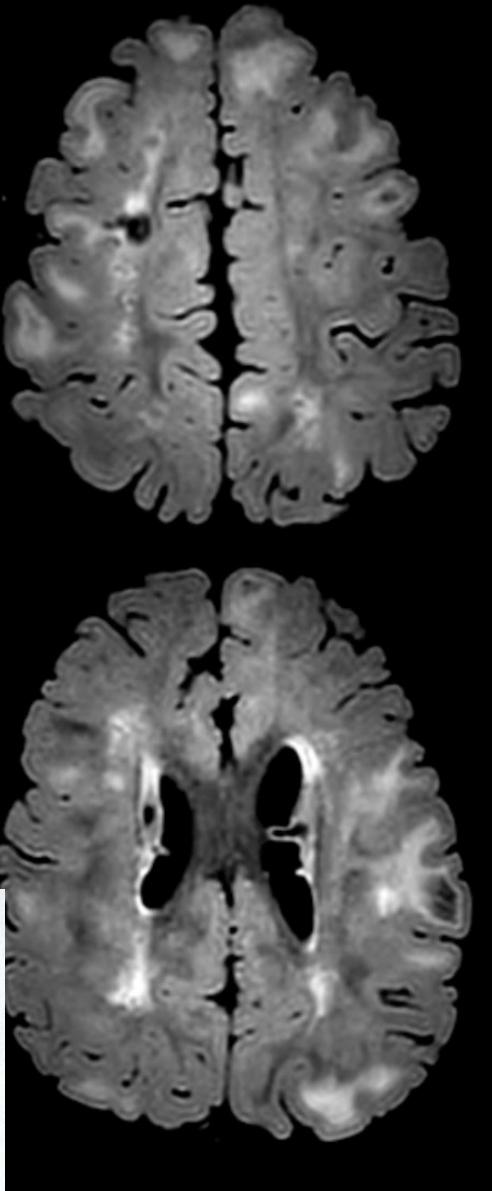
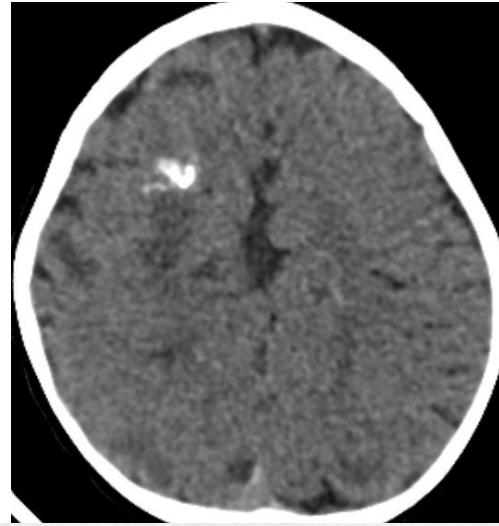
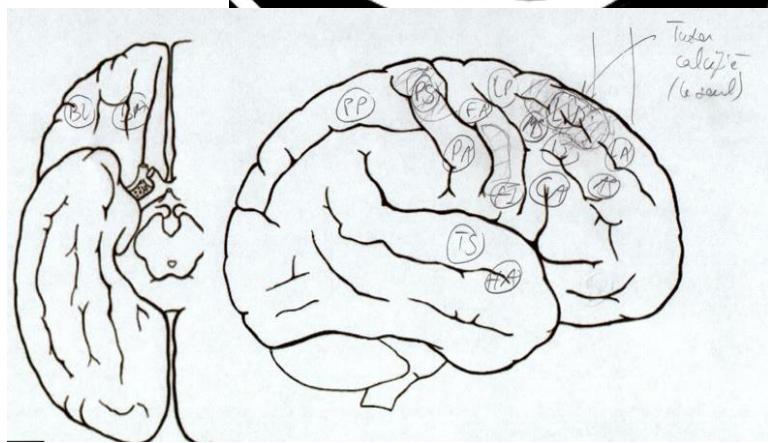
- Souvent bien limitées sur l'IRM
- EEG: Topographie des anomalies à l'EEG souvent concordantes avec la lésion (Chassoux, 2012)
- CAT:
 - 1) Adressage neurochir
 - 2) Validation temporalité en RCP oncologique
 - 3) Tumorectomie +/- exploration EEG/ SEEG ++ si nécessaire



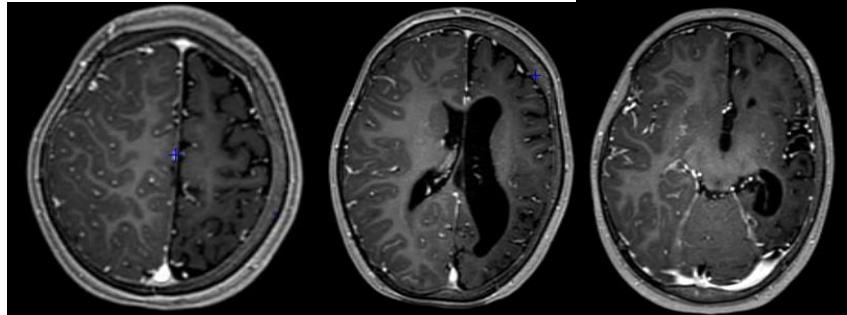
Sclérose Tubéreuse de Bourneville

- Syndrome neurocutané (TSC 1-2)
- **Question:** Tuber éligible malgré tubers multiples / IC multifocal?
- ZE > tuber => SEEG
- Parcours chirurgical en plusieurs temps si nécessaire (« allumage successif de tubers ») au cours de l'histoire
- Intérêt: préservation cognitive pour passer des milestones développementaux ++

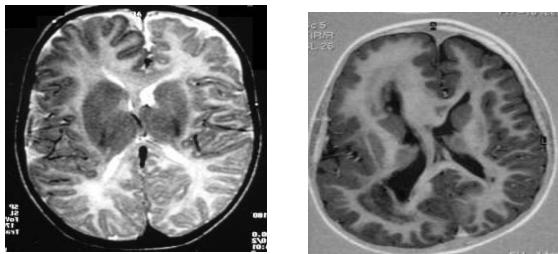
ZEH..Leh..



Epilepsies hémisphériques



HHE (hémiconvulsion-hémiplégie-épilepsie)

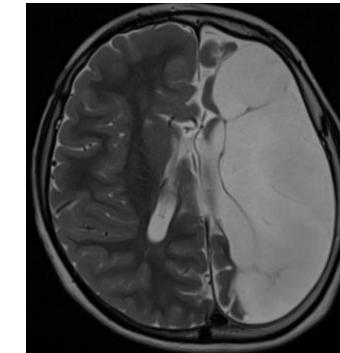


Dysplasie corticale

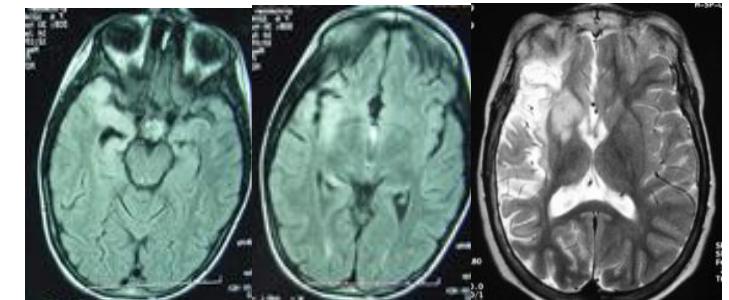


Sturge Weber

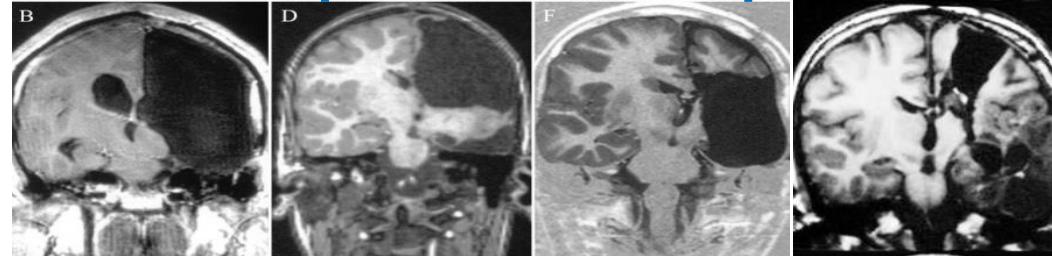
Séquelles AVC



Encéphalite Rasmussen



Candidats pour une hémisphérotomie



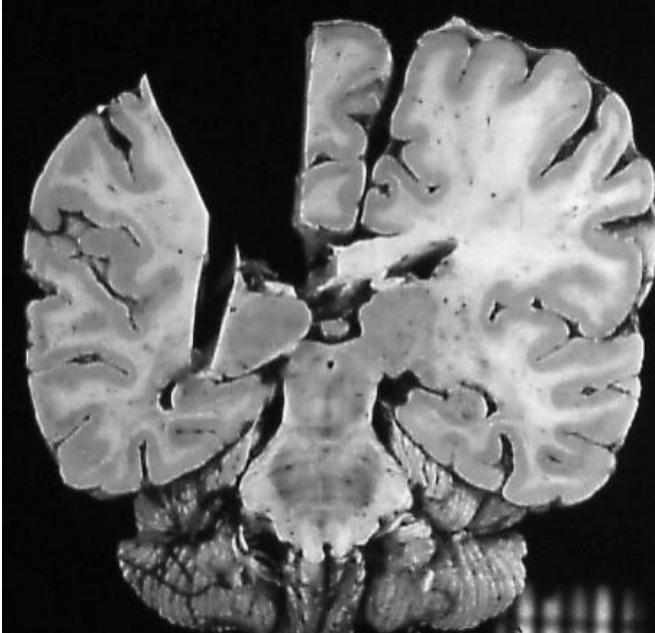
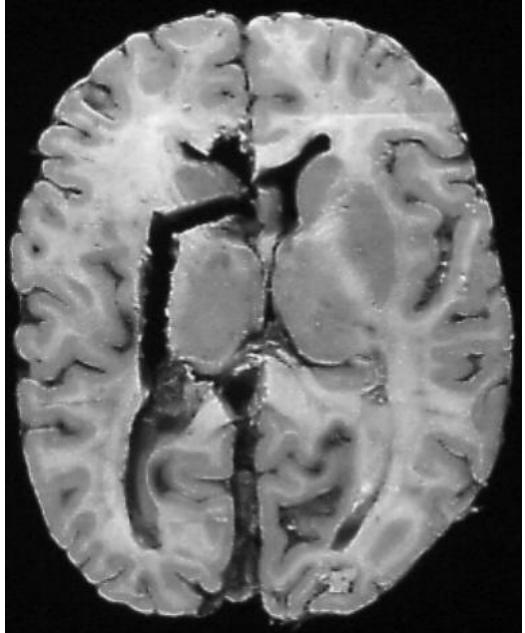
Hémiphérotomie verticale parasagittale

Olivier Delalande, M.D.
Fondation Ophtalmologique
A. de Rothschild,
Pediatric Neurosurgery Unit,
Paris, France

Christine Bulteau, M.D.
Fondation Ophtalmologique

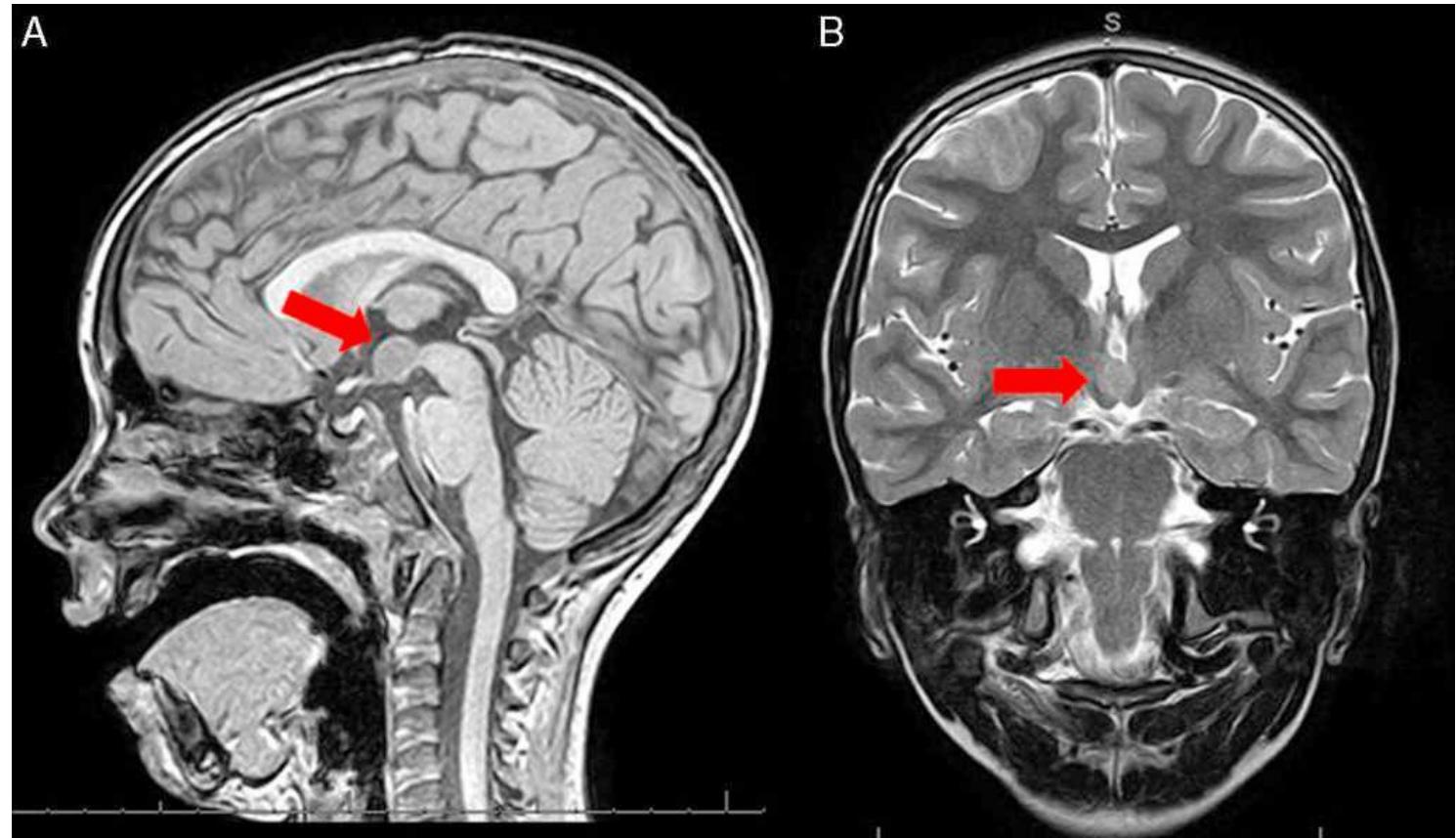
VERTICAL PARASAGITTAL HEMISPHEROTOMY: SURGICAL PROCEDURES AND CLINICAL LONG-TERM OUTCOMES IN A POPULATION OF 83 CHILDREN

Neurosurgery 2007



Hamartomes hypothalamiques

- 1/50 000-1/100 000
- Lésion congénitale , hétérotopique, non néoplasique
- Neurones et cellules gliales
- Attaché à
 - Partie inférieure de l'hypothalamus (plancher/mur)
 - Tuber cinereum
 - Corps mamillaires
- Isolé ou Associé
 - Autres lesions cérébrales
 - +/- Sd Pallister Hall
(GLI3/SHH <1 / 1 000 000)



Hamartomes hypothalamiques

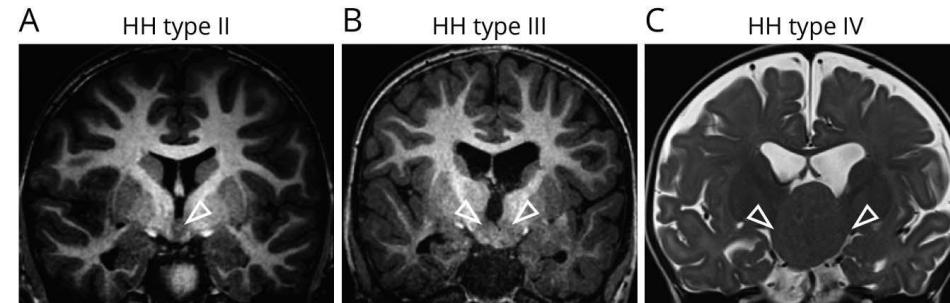
Classification de Delalande

Signes cliniques:

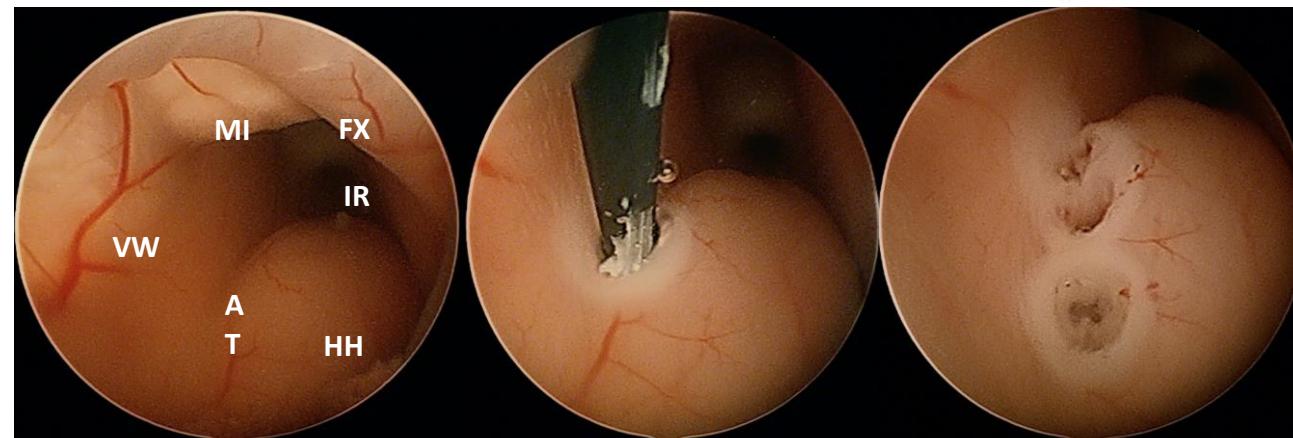
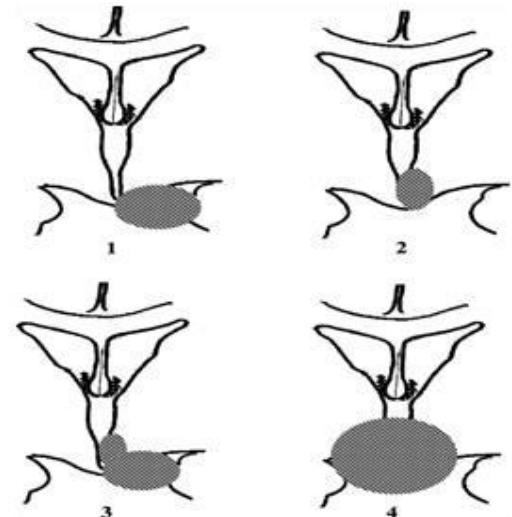
Puberté précoce

Crises d'épilepsie:

- Crises gélastiques
- Crises polymorphes +/- EE
- Pharmacorésistance +++
- +/- Déficience intellectuelle progressive
- +/- Tb du comportement: rage, TSA
- Asymptomatique: < 10%



Fohlen M, 2003, Procarini, 2006



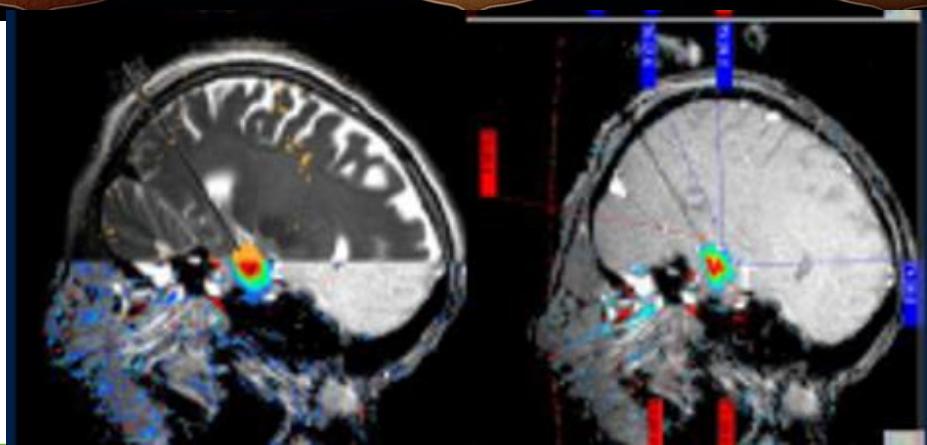
Approches chirurgicales:

Déconnexion endoscopique (intra -V3)

LITT (Laser Interstitial Thermal Therapy)

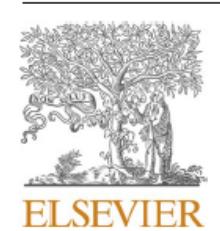
Objectifs :

- déconnexion de l'HH laissé en place
- épargne corps mamillaires/hypothalamus



Chirurgies « non curatives »

Callosotomie



Complete callosotomy in children with drop attacks; A retrospective monocentric study of 50 patients

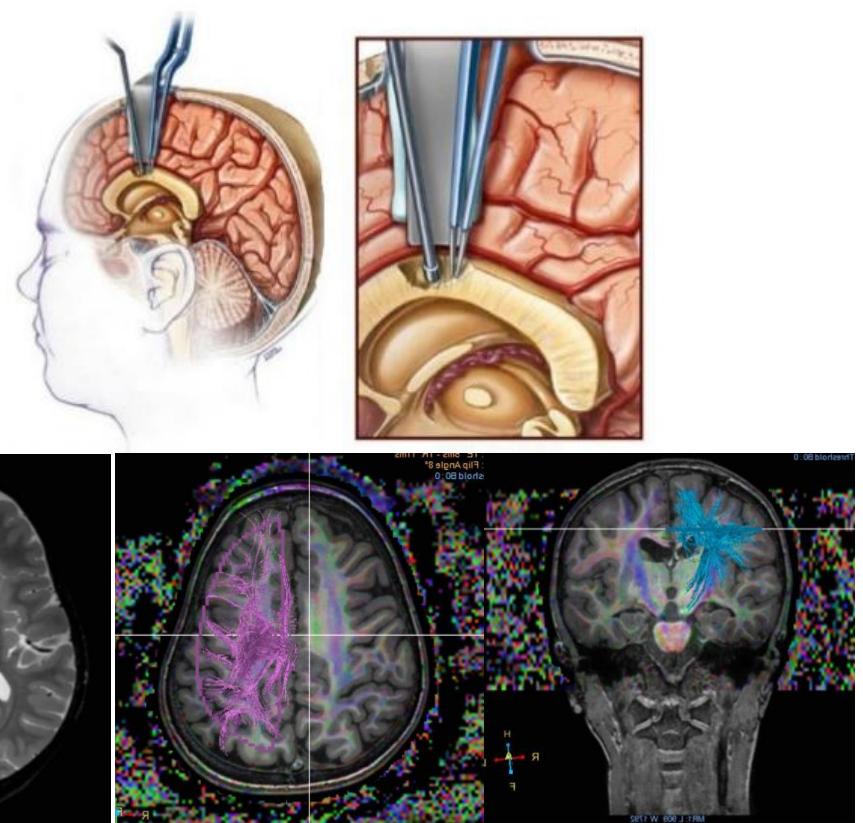
Sarah Ferrand-Sorbets ^{a,*}, Martine Fohlen ^a, Pierre Bourdillon ^b, Mathilde Chipaux ^a, Christine Bulteau ^{a,c}, Laurent Goetz ^a, Olivier Delalande ^a, Delphine Taussig ^{a,d}, Georg Dorfmuller ^a

^a Pediatric Neurosurgery Department, Rothschild Foundation Hospital, Paris, France

^b Neurosurgery Department, Rothschild hospital foundation

^c University of Paris, MC2Lab, Institute of Psychology, F-92100 Boulogne-Billancourt, France

^d Université Paris Saclay-APHP, Neurophysiologie et Epileptologie, Le Kremlin Bicêtre, France



➤ **Indication:**

- épilepsie pharmacorésistante, multifocale
- non accessible à une chirurgie curative/résective,
- Induisant crises avec **chutes**

➤ **Physiopathologie:** Corps calleux: voie de propagation majeure entre les deux hémisphères

➤ **Objectif de la série:** identification de marqueurs cliniques prédictifs d'un meilleur outcome sur Drop attacks et les autres types de crises



Complete callosotomy in children with drop attacks; A retrospective monocentric study of 50 patients



Sarah Ferrand-Sorbets ^{a,*}, Martine Fohlen ^a, Pierre Bourdillon ^b, Mathilde Chipaux ^a,
Christine Bulteau ^{a,c}, Laurent Goetz ^a, Olivier Delalande ^a, Delphine Taussig ^{a,d},
Georg Dorfmuller ^a

^a Pediatric Neurosurgery Department, Rothschild Foundation Hospital, Paris, France

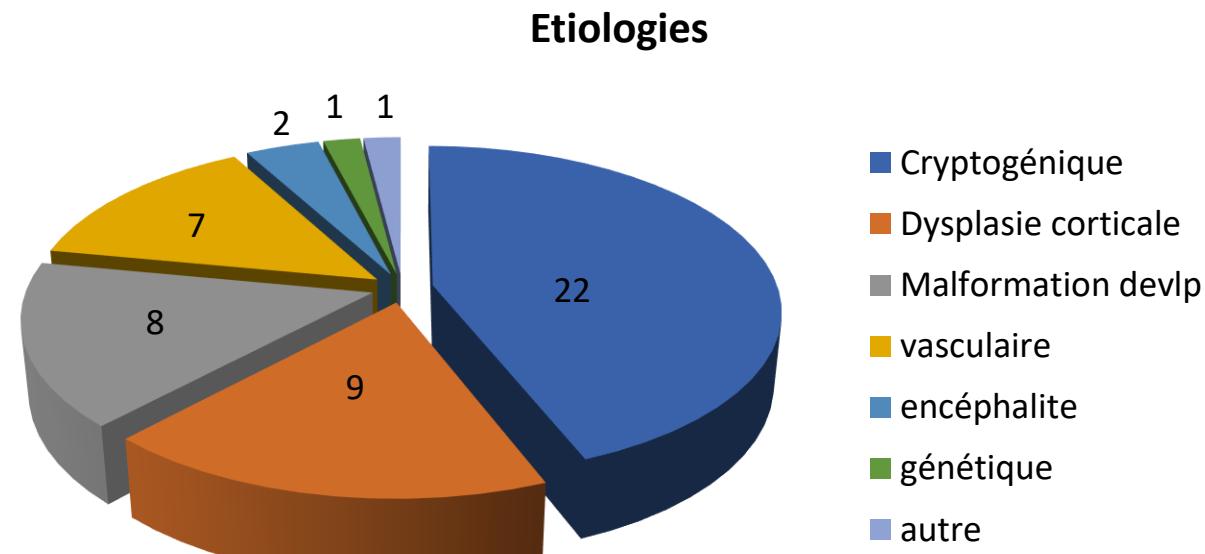
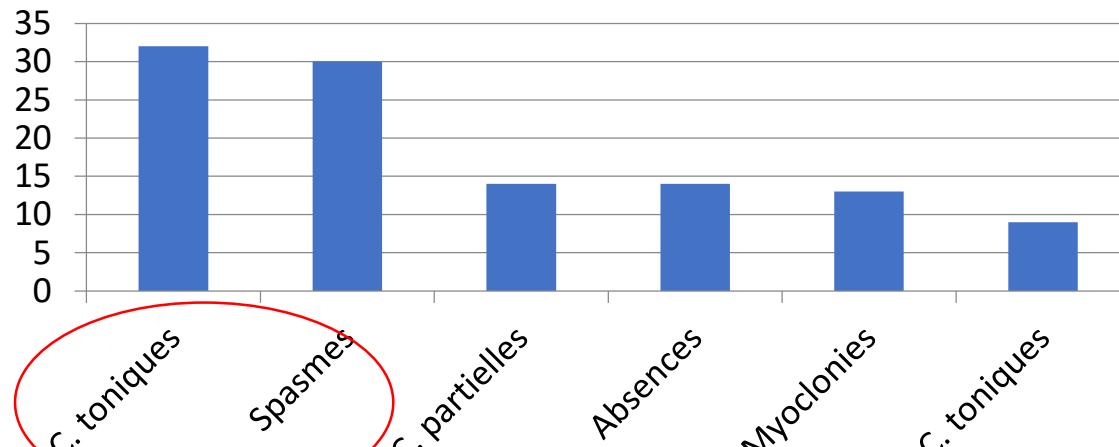
^b Neurosurgery Department, Rothschild hospital foundation

^c University of Paris, MC2Lab, Institute of Psychology, F-92100 Boulogne-Billancourt, France

^d Université Paris Saclay-APHP, Neurophysiologie et Epileptologie, Le Kremlin Bicêtre, France

Crises au moment de la chirurgie

Syndrome: SLG 45/50 patients



- Cryptogénique
- Dysplasie corticale
- Malformation devlp
- vasculaire
- encéphalite
- génétique
- autre



Complete callosotomy in children with drop attacks; A retrospective monocentric study of 50 patients

Sarah Ferrand-Sorbets ^{a,*}, Martine Fohlen ^a, Pierre Bourdillon ^b, Mathilde Chipaux ^a, Christine Bulteau ^{a,c}, Laurent Goetz ^a, Olivier Delalande ^a, Delphine Taussig ^{a,d}, Georg Dorfmüller ^a

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^c University of Paris, MC2Lab, Institute of Psychology, F-92100 Boulogne-Billancourt, France

^d Université Paris-Saclay-APHP, Neurophysiologie et Epileptologie, Le Kremlin Bicêtre, France

- 82% évolution favorable au dernier FU (>50% réduction crises)

- Dont **58 % libres de chutes** à long terme

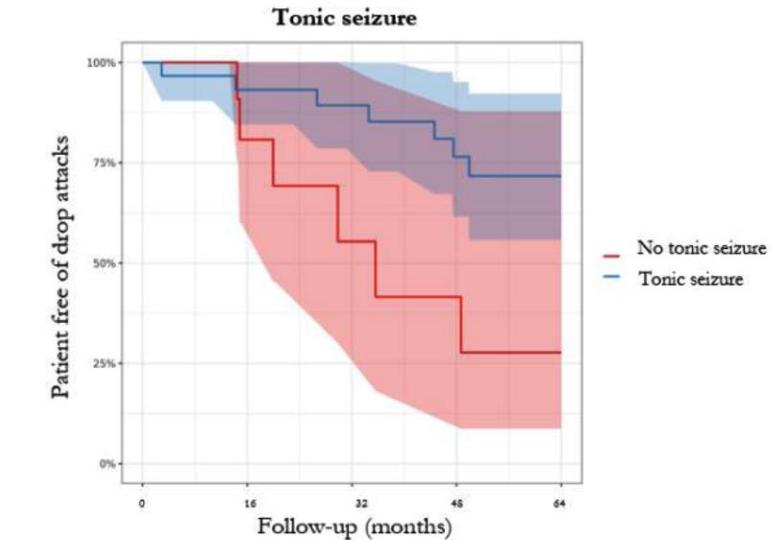
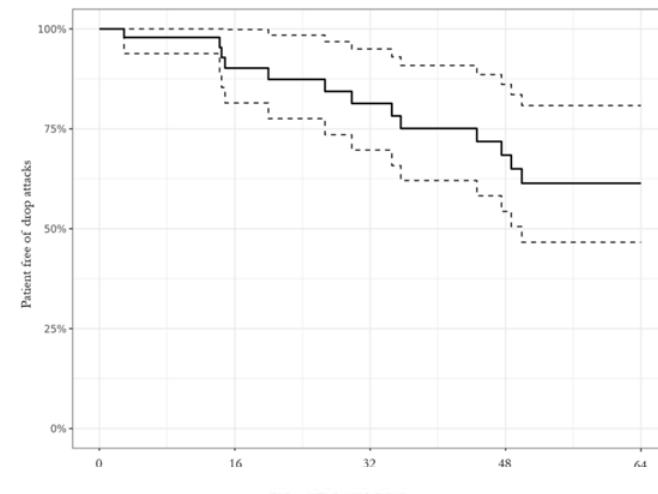
- **Efficacité sur Crises toniques +++ ($p=0,017$)**

- Ne sont pas des facteurs influençant l'évolution:
Age à la chirurgie (7,5ans), Age au début des crises (7 mois)

- Complications mineures et transitoires:

- 2 patients HSD résolutif
- 2 patients bon niveau de langage (tb cognitif léger) ont présenté sd de déconnexion **TRANSITOIRE** avec récupération **AD-INTEGRUM** => **PAS de syndrome de déconnexion après callosotomie totale dans l'enfance (< adolescence)**

Callosotomy chez l'enfant



**Corpus callosotomy outcomes in pediatric patients:
A systematic review**

*†David Graham, ‡Martin M. Tisdall, and *†Deepak Gill N=

Epilepsia, 57(7):1053–1068, 2016
doi: 10.1111/epi.13408

N1= 180 calloso complète
N2= 125 calloso 2/3 ant
N3= 3 calloso post

Disconnection syndrome

- Common (n = 20; 7.0%)
- **Always transient and resolved within 6 weeks post- surgery**

Disconnection syndrome only occurred in children with either LGS or severe intellectual disability, with one notable exception in the series of Cendes et al.:
a **15-year-old female with normal intelligence** (patient 21)

CAT: précaution CC 2/3 antérieurs si age > puberté et bon niveau de langage

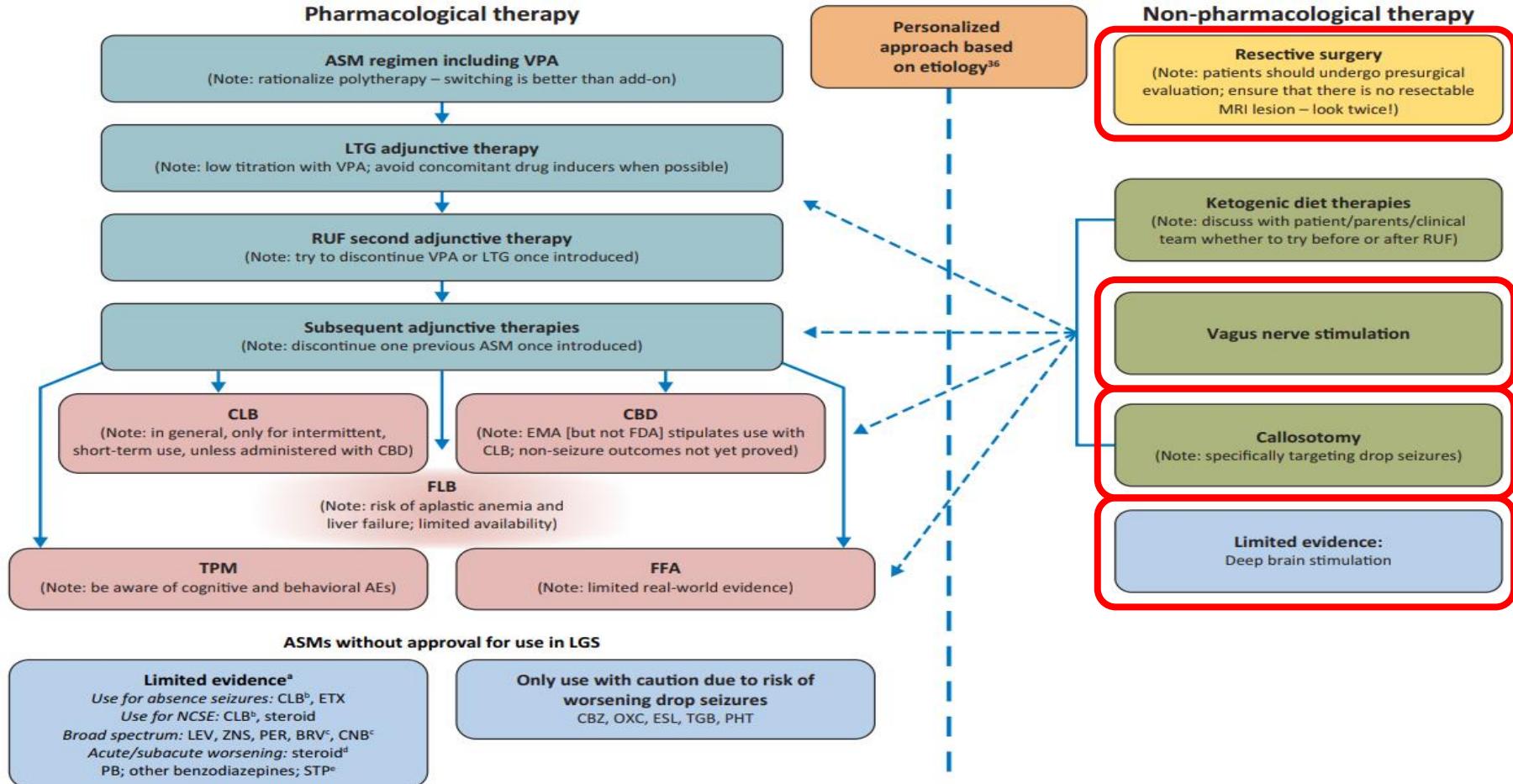
Quels patients pour la callosotomie?

AUVIN ET AL.

Epilepsia Open®

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13



Quels patients pour la callosotomie?

AUVIN ET AL.

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Pharmacological therapy

ASM regimen including VPA

(Note: rationalize polytherapy – switching is better than add-on)

Personalized approach based on etiology³⁶

Non-pharmacological therapy

Resective surgery

(Note: patients should undergo presurgical evaluation; ensure that there is no resectable AED lesion – look twice!)

Received: 13 April 2022

Accepted: 18 July 2022

DOI: 10.1002/epi4.12631

ORIGINAL ARTICLE

Epilepsia Open®

Open Access

Asymmetric epileptic spasms after corpus callosotomy in children with West syndrome may be a good indicator for unilateral epileptic focus and subsequent resective surgery

Daiki Uchida^{1,2}  | Tomonori Ono^{1,3}  | Ryoko Honda^{3,4}  |

Yoshiaki Watanabe^{3,4} | Keisuke Toda⁵ | Shiro Baba²  | Takayuki Matsuo² |

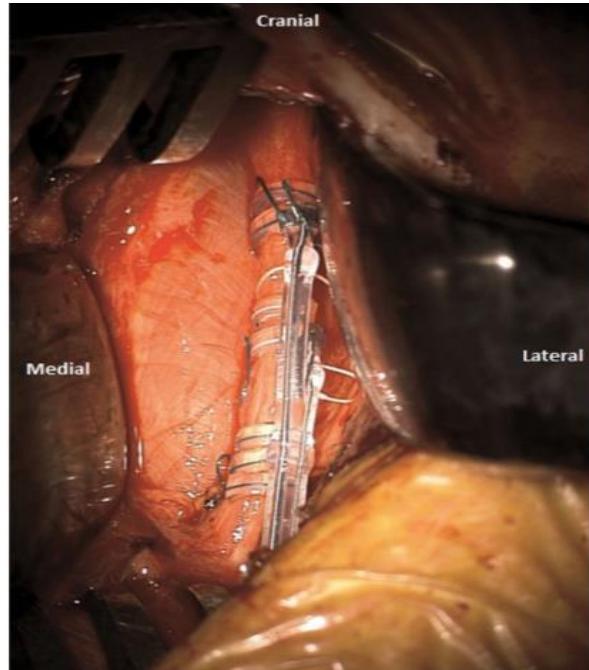
Hiroshi Baba⁶

B
Acute/subacute worsening: steroid^d
PB; other benzodiazepines; STP^e

!

Neuromodulation :
Vagal Nerve Stimulation
DBS épilepsie

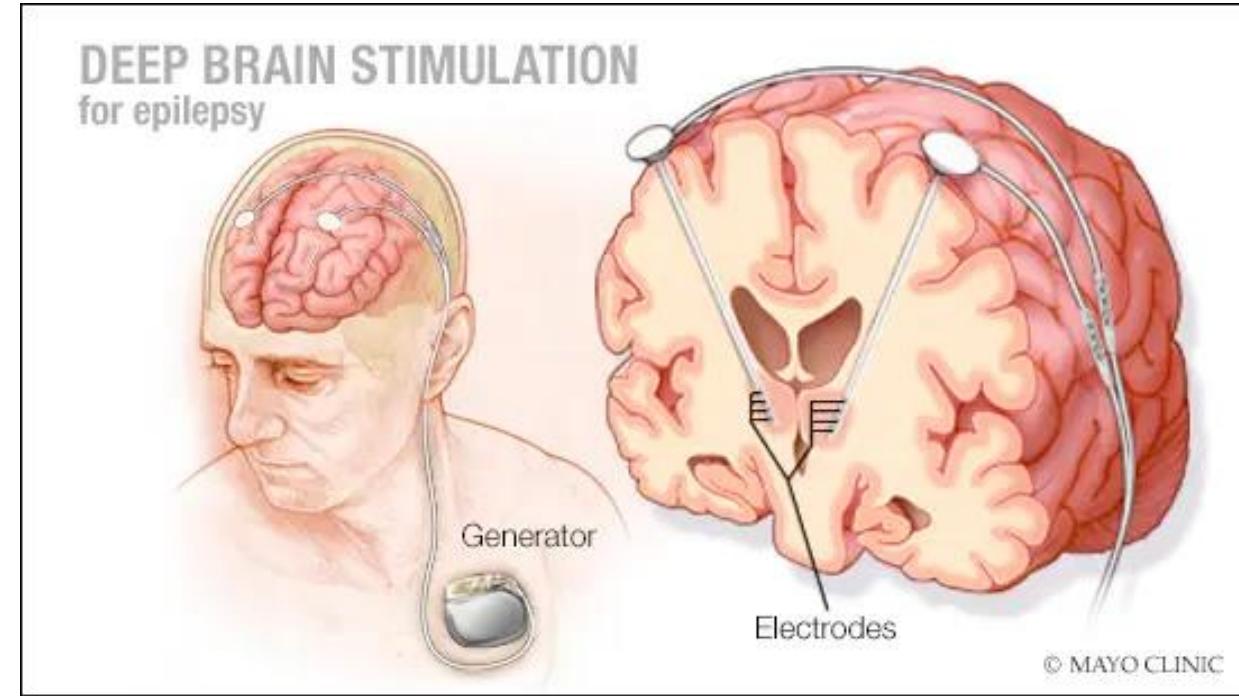
VNS chez l'enfant



- I) >50% Seizure reduction
- II) Duration, severity, QoL, CGI, safety
- Few complications

Elliott 2011 J Neurosurgery; Iren Orosz 2014 Epilepsia;
Puneet Jain 2021 Neurology méta-analyse de 101 études

DBS: noyau ciblé selon le type d'épilepsie



CentroMedian Nucleus: Generalized Ep., LGS, Absences
Anterior Nucleus: Temporal Ep. (Etude SANTE)
Pulvinar: Parieto-Occipital Ep.

Velasco et 2021, Fischer and Velasco, 2014, Lehtimäki et al, 2019



Chirurgies « palliatives » dans le SLG

- **Cukiert et al, 2013, and Thirunavu et al, 2021:** callosotomie > VNS drop attacks.
- **Katagiri et al : Intérêt de la combination VNS après callosotomie dans le Lennox-Gastaut**
- **Kanai et al. in 2017:** combination de callosotomie et VNS patient avec Doose syndrome
- **Rolston et al, 2015:** Meilleure efficacité de la callosotomie versus VNS
- **Lancman et al, 2013:** Meilleure efficacité sur les crises atoniques de la callosotomie, Efficacité similaire sur autres types de crises

Effet SYNERGIQUE des thérapeutiques !

Lancman et al, Seizure, 20213 VNS versus Corpus callosotomy in the treatment of Lennox Gastaut, a meta analysis

Rolston et al, Epilepsia, 2015. Corpus callosotomy versus VNS for atonic seizures and drop attacks: a systematic review

Cukiert A, et al. Long-term outcome after callosotomy or vagus nerve stimulation in consecutive prospective cohorts of children with Lennox-Gastaut or Lennox-like syndrome and non-specific MRI findings. Seizure 2013

Cukiert A, et al. A prospective long-term study on the outcome after vagus nerve stimulation at maximally tolerated current intensity in a cohort of children with refractory secondary generalized epilepsy. Neuromodulation 2013;

Thirunavu V, et al. . The role of surgery in the management of Lennox-Gastaut syndrome: A systematic review and meta-analysis of the clinical evidence. Epilepsia 2021

Katagiri M, Iida K, Kagawa K, Hashizume A, Ishikawa N, Hanaya R, et al. Combined surgical intervention with vagus nerve stimulation following corpus callosotomy in patients with Lennox-Gastaut syndrome. Acta Neurochir 2016

Kanai S, Okanishi T, Nishimura M, Iijima K, Yokota T, Yamazoe T, et al. Successful corpus callosotomy for Doose syndrome. Brain Dev 2017;39:882–5.

Action synergique VNS+ DBS !

CAT Enfant avec SLG

VPA+ LTG, CBD, RUF, Fenflu, RK

En parallèle: parcours chirurgical multi-step

⇒ si chute : callosotomie refocalisation des anomalies?

⇒ Add-on VNS

⇒ Add-on DBS

Add-On Deep Brain Stimulation versus Continued Vagus Nerve Stimulation for Childhood Epilepsy (ADVANCE): A Partially Randomized Patient Preference Trial

Hrishikesh Suresh, MD   ^{1,2,3}

Karim Mithani, MD, MEng  ^{1,2,3}

Nebras Warsi, MD, CM, ^{1,2,3}

Ayako Ochi, MD, ⁴ Hiroshi Otsubo, MD, ⁴

James M. Drake, MD MSc, ^{3,5}

James T. Rutka, MD, PhD, ^{3,5}

Elizabeth Kerr, PhD, ⁴

Mary Lou Smith, PhD, ^{2,4}

Sara Breitbart, MN, ⁵

Ivanna Yau, MN, NP-Pediatric, ⁴

Lyndsey McRae, MN, NP-PHC, ⁴

Vann Chau, MD, ⁴ Shelly Weiss, MD, ⁴

Puneet Jain, DM, ⁴ Elizabeth Donner, MD, ⁴

Alfonso Fasano, MD, PhD, FAAN, ^{4,6,7,8,9}

Carolina Gorodetsky, MD, MSc  ⁴ and

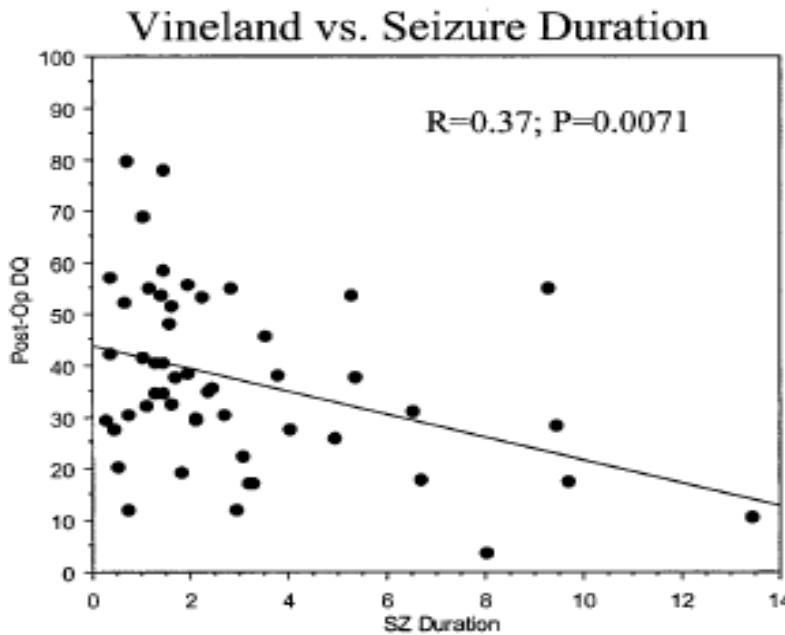
George M. Ibrahim, MD, PhD, FRCSC  ^{1,2,3,5,6}

Outcomes following vagus nerve stimulation (VNS) improve over years after implantation in children with drug-resistant epilepsy. The added value of deep brain stimulation (DBS) instead of continued VNS optimization is unknown. In a prospective, non-blinded, randomized patient preference trial of 18 children (aged 8–17 years) who did not respond to VNS after at least 1 year, add-on DBS resulted in greater seizure reduction compared with an additional year of VNS optimization (51.9% vs. 12.3%, $p = 0.047$). Add-on DBS also resulted in less bothersome seizures ($p = 0.03$), but no change in quality of life. DBS may be considered earlier for childhood epilepsy after non-response to VNS.

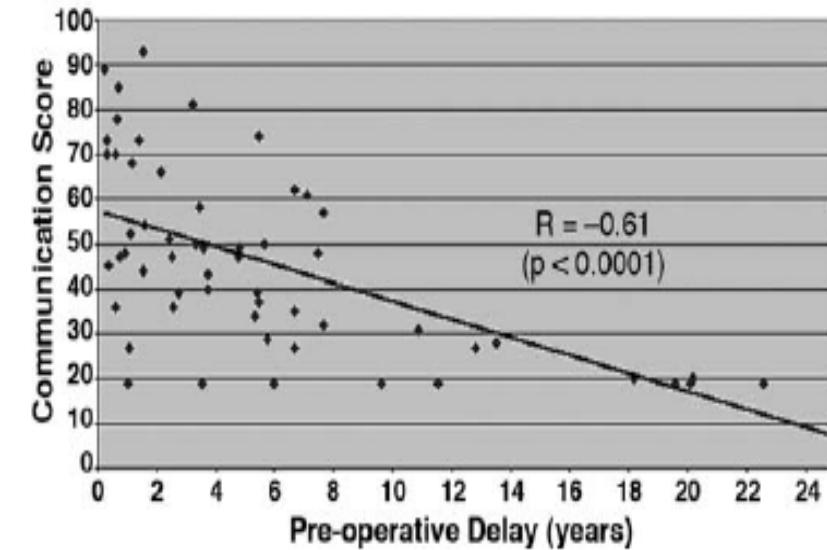
La chirurgie pour quoi faire?

Histoire naturelle de la maladie: installation de déficits cognitifs et des capacités adaptatives

n=52



n=58



Chassoux, 2012; Jonas, 2004; Delalande, 2007)

Timing chirurgical = le plus tôt possible





Epilepsy surgery for children and adolescents: evidence-based but underused

J Helen Cross, Colin Reilly, Eva Gutierrez Delicado, Mary Lou Smith, Kristina Malmgren

Lancet Child Adolesc Health

2022; 6: 484–94

Published Online

May 11, 2022

[https://doi.org/10.1016/S2352-4642\(22\)00098-0](https://doi.org/10.1016/S2352-4642(22)00098-0)

2022 Review chirurgie de l'épilepsie chez l'enfant, toutes étiologies confondues

• CRISES

	Resection type	Number of studies included	Total number of patients	Follow-up	Patients who were seizure-free at follow-up (%)	Seizure freedom definition
Englot et al (2013) ³⁰	Temporal lobe resection	38	1318	≥1 year	76%	Engel class I
Englot et al (2013) ³²	Extratemporal resections	36	1259	≥1 year	56%	Engel class I
Griessnauer et al (2015) ³¹	Hemispherotomy	29	1102	≥1 year	73%	Engel class I
Widjaja et al (2020) ³³	Temporal and extratemporal resections, hemispherotomy	258	Not specified	1 year, 5 years, and 10 years	65% at 1 year, 60% at 5 years, 40% at 10 years	Not specified

Table: Systematic reviews of seizure outcome after paediatric epilepsy surgery

- DEVELOPPEMENT
- EI ou QD chez < 3a

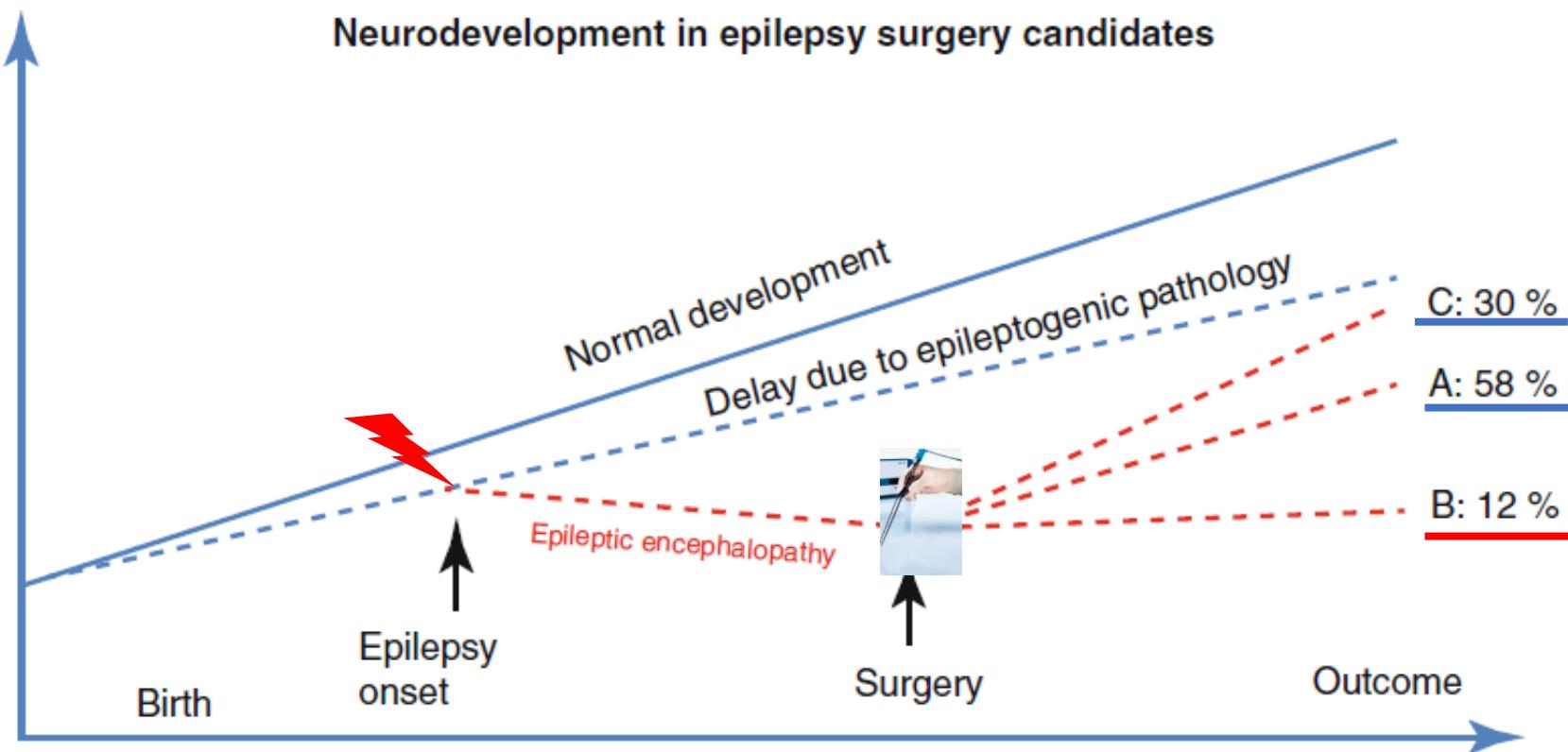
- 85% : stabilité ou amélioration
- 15% déterioration (pré-post au dernier FU) mais devrait comparer postop vs histoire naturelle de la maladie (ex: Skirrow et al. *Neurology epilepsies temporales opérés vs non opérés*)

- Amélioration du QI:
 - surtout si QI préopératoire était bas : ne pas récuser un patient très impacté (EE +++)
 - corrélé au retrait des médicaments
- Intégration socioprofessionnelle: Meilleur niveau d'éducation, meilleure intégration sociétale (FU 20 ans)

Devenir cognitif après chirurgie de l'épilepsie dans l'enfance

Baldeweg & Skirrow Long term cognitive outcome after Epilepsy Surgery in Children 2015

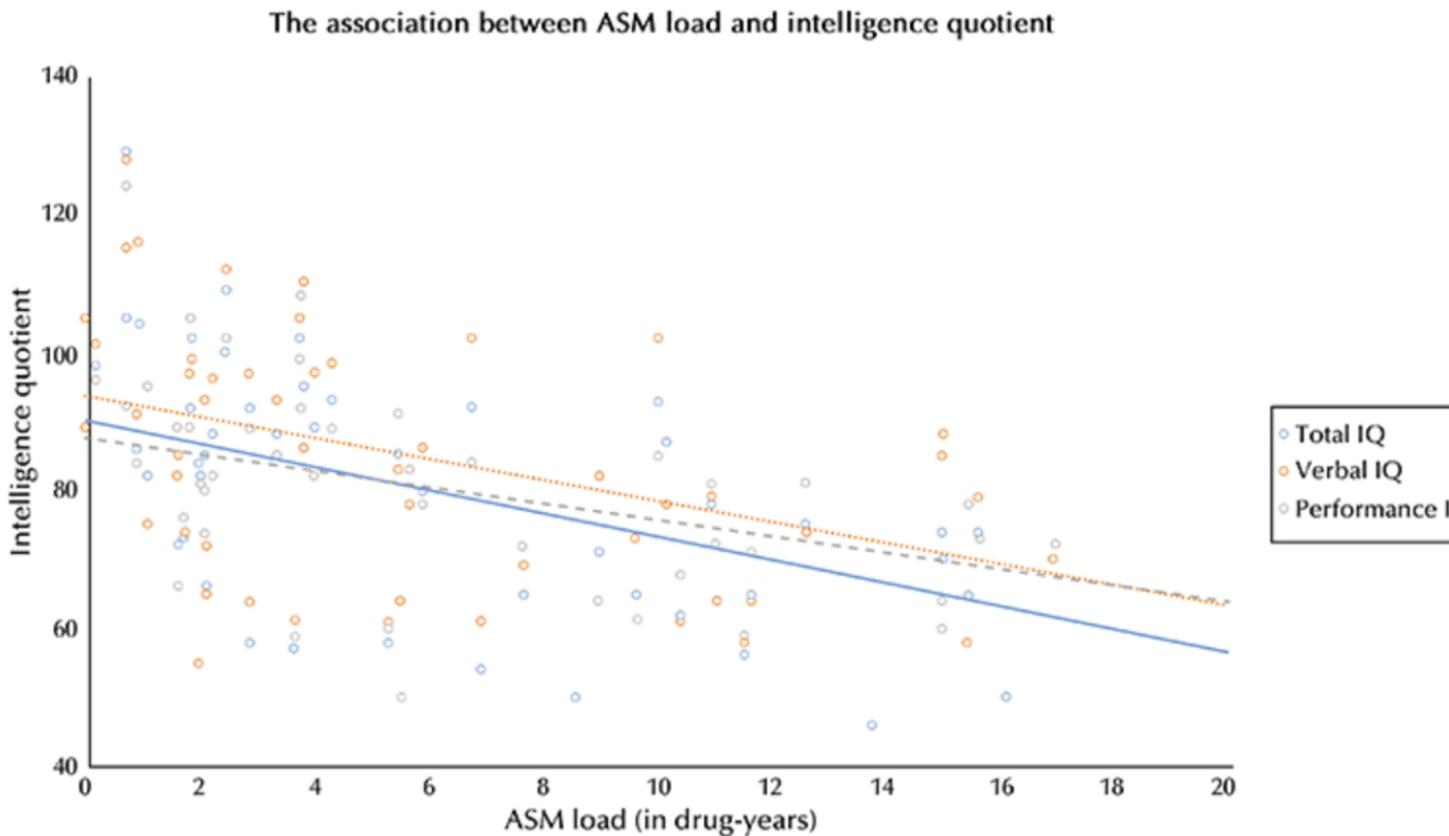
In : Malmgren K, Baxendale S & Cross H Long term outcomes of Epilepsy Surgery in Adults and children Springer Editors 2015



Edinburgh Research Explorer

Cumulative effects of antiseizure medication on intelligence in children with focal epilepsy**Citation for published version:**

Stevering, CH, Lamberink, HJ, Woodfield, J, van Schooneveld, M, Otte, WM, Chin, R, Bastin, ME, Geleijns, K & Braun, KPJ 2022, 'Cumulative effects of antiseizure medication on intelligence in children with focal epilepsy', *Epileptic Disorders*, vol. 24, no. 5. <https://doi.org/10.1684/epd.2022.1467>



- 59 patients, 5 à 12 ans, épilepsie focale
- **I) Tester association entre :**
 - Charge cumulée en anti-épileptique exprimée en unités « année de traitement »
1 année de traitement = 1 AE pris durant 1 an
 - QI: total, verbal , performance
- Régression linéaire multiple avec ajustement sur **covariables de gravité de l'épilepsie**:
 - Age au début de traitement
 - Etiologie
 - Fréquence maximale de crises
 - Durée de l'épilepsie
 - Atcd généralisations secondaires
 - Atcd états de mal
 - Nombre de médicaments

QUID de l'APRES chirurgie?

Accompagnement de l'enfant et de la famille

- Dynamique familiale pré et postopératoire : construction autour de la maladie
- Les crises disparaissent brutalement dès la chirurgie

Mais pas les troubles associés : “HANDICAP INVISIBLE”

- Chirurgie fait le lit des rééducations (T0)
- Cerveau de l'enfant vulnérable mais plastique : amélioration progressive et dynamique

CAT:

- PeC long-terme des troubles associés +++ (18m, 3a,5a,10a postop)
- Prise en soins globale
 - Coordinations des rééducations
 - Soutien psychologique, Séjours de répit
 - Aménagements pédagogiques
 - Aides sociales (MDPH), SESSAD
 - Orientation scolaire/medico-éducative adaptée à chaque étape

Take home messages

La chirurgie de l'épilepsie chez l'enfant

Pour quand? Le plus tôt possible, **dès échec 2 lignes de traitement**

Pour qui? Outil sur-mesure

Décision à l'issue du parcours d'évaluation préchirurgical , **pensez à adresser !**

Pour quoi? Efficacité sur les **crises** + Milestones **développementaux**

Objectifs: **Qualité de vie et autonomie**



