NEUROMED I.R.C.C.S. ISTITUTO NEUROLOGICO MEDITERRANEO

LICE Lega Italiana Contro l'Epilessia

CORSO VIDEO EEG LICE
3° EDIZIONE
CATANIA, 24-27 OTTOBRE 2021

Martedì 26 ottobre

Moderatori:
Francesco Pisani (Messina) – *Rosalia Silvestri* (Messina)

Manifestazioni motorie

LE CRISI E LE EPILESSIE DEL LOBO FRONTALE

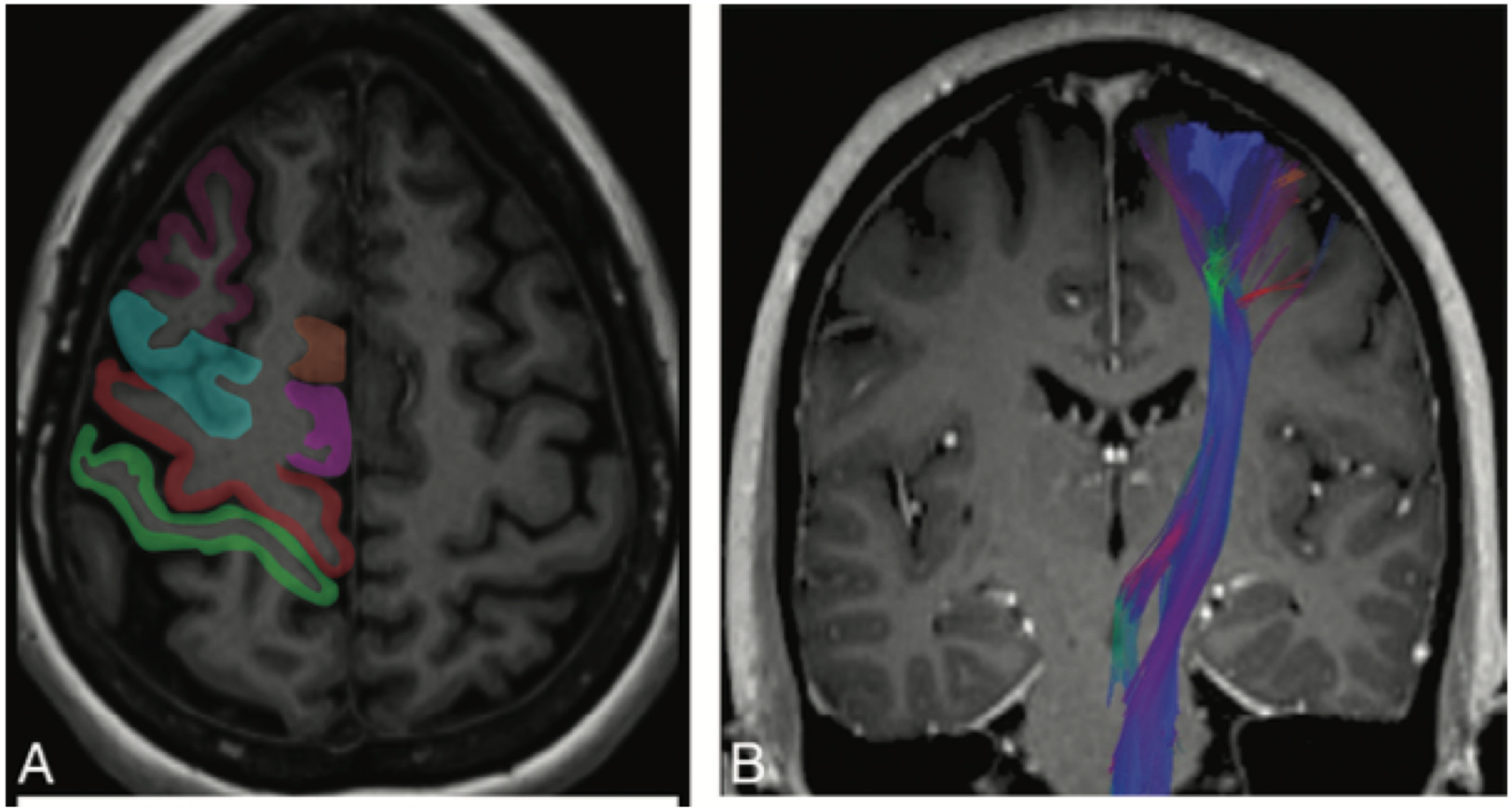
Giancarlo Di Gennaro

Outline

- Anatomy/Physiology
- From clinical semiology to localization
- Lateralizing value of motor signs in FLE
- Unilateral clonic seizures
- Epileptic negative myoclonus
- Unilateral tonic seizures
- Bilateral tonic facial contraction
- Bilateral tonic seizures (SSMA, insula)
- Hand posture
- Eye and head deviation
- Rotatory seizures

Anatomy and physiology (1)

Frontal lobe motor areas



Published June 13, 2019 as 10.3174/ajnr.A6089

REVIEW ARTICLE
FUNCTIONAL

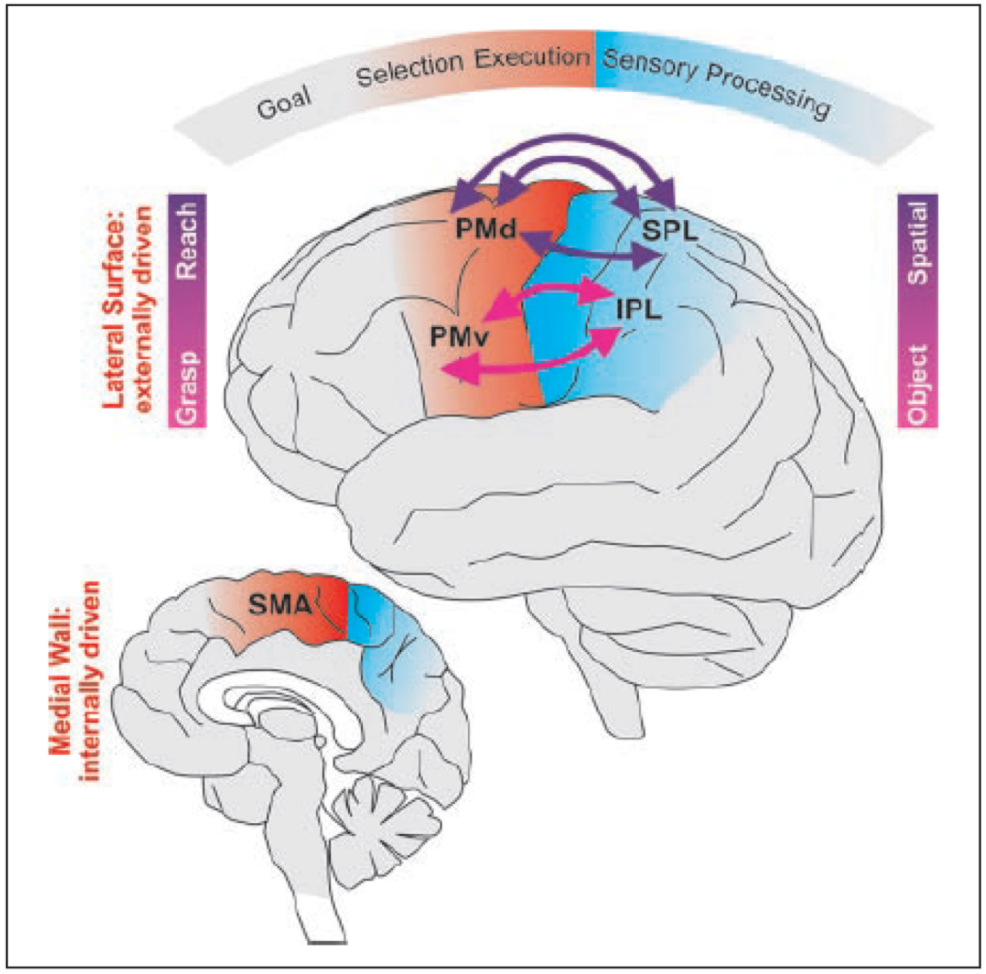
A Practical Review of Functional MRI Anatomy of the Language and Motor Systems

V.B. Hill, C.Z. Cankurtaran, B.P. Liu, T.A. Hijaz, M. Naidich, A.J. Nemeth, J. Gastala, C. Krumpelman, E.N. McComb, and A.W. Korutz

- Sensory cortex
- Motor cortex
- Premotor cortex
- SSMA
- Pre-SSMA
- Dorsolateral prefrontal cortex

Anatomy and physiology (2)

Parieto-premotor connections



Neurorehabilitation and Neural Repair
Supplement to 25(5) 65–205
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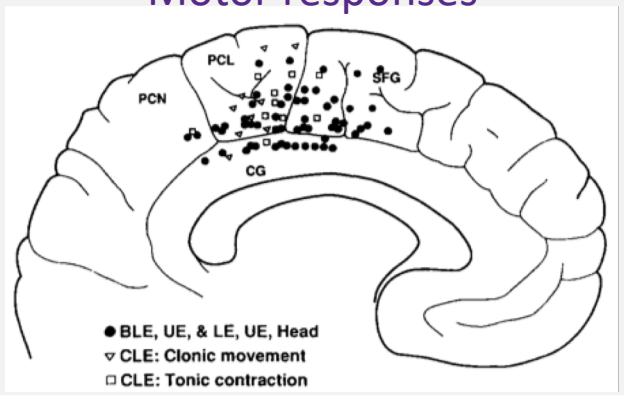
DOI: 10.1177/1545968311410940
http://nnr.sagepub.com
SAGE

Neurological Principles and Rehabilitation of Action Disorders: Computation, Anatomy, and Physiology (CAP) Model

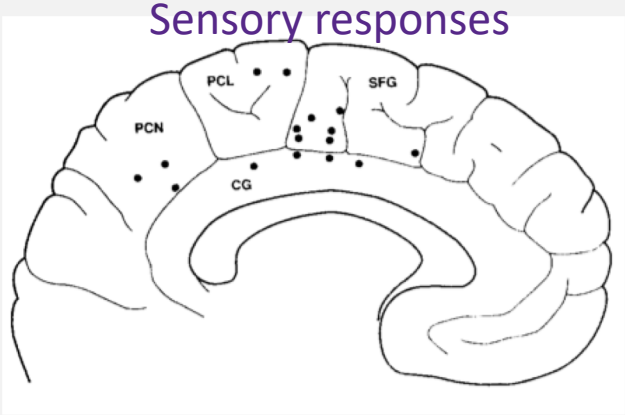
Scott H. Frey, PhD[1], Leonardo Fogassi, PhD[2], Scott Grafton, MD[3], Nathalie Picard, PhD[4], John C. Rothwell, PhD[5], Nicolas Schweighofer, PhD[6], Maurizio Corbetta, MD[7], and Susan M. Fitzpatrick, PhD[7,8]

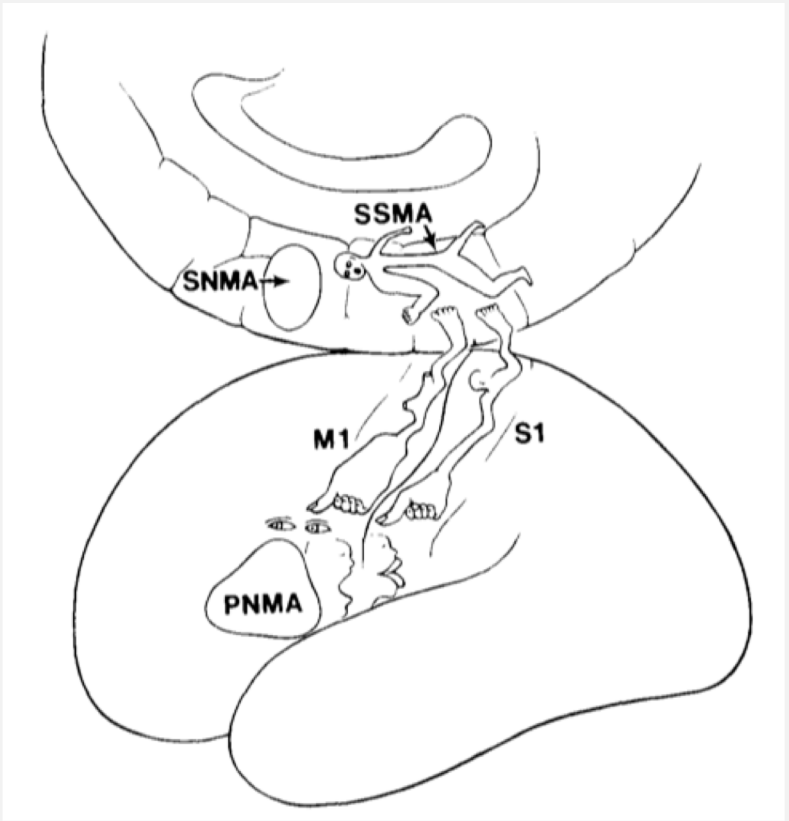
Anatomy and physiology (SSMA homunculus) (3)

Motor responses



Sensory responses

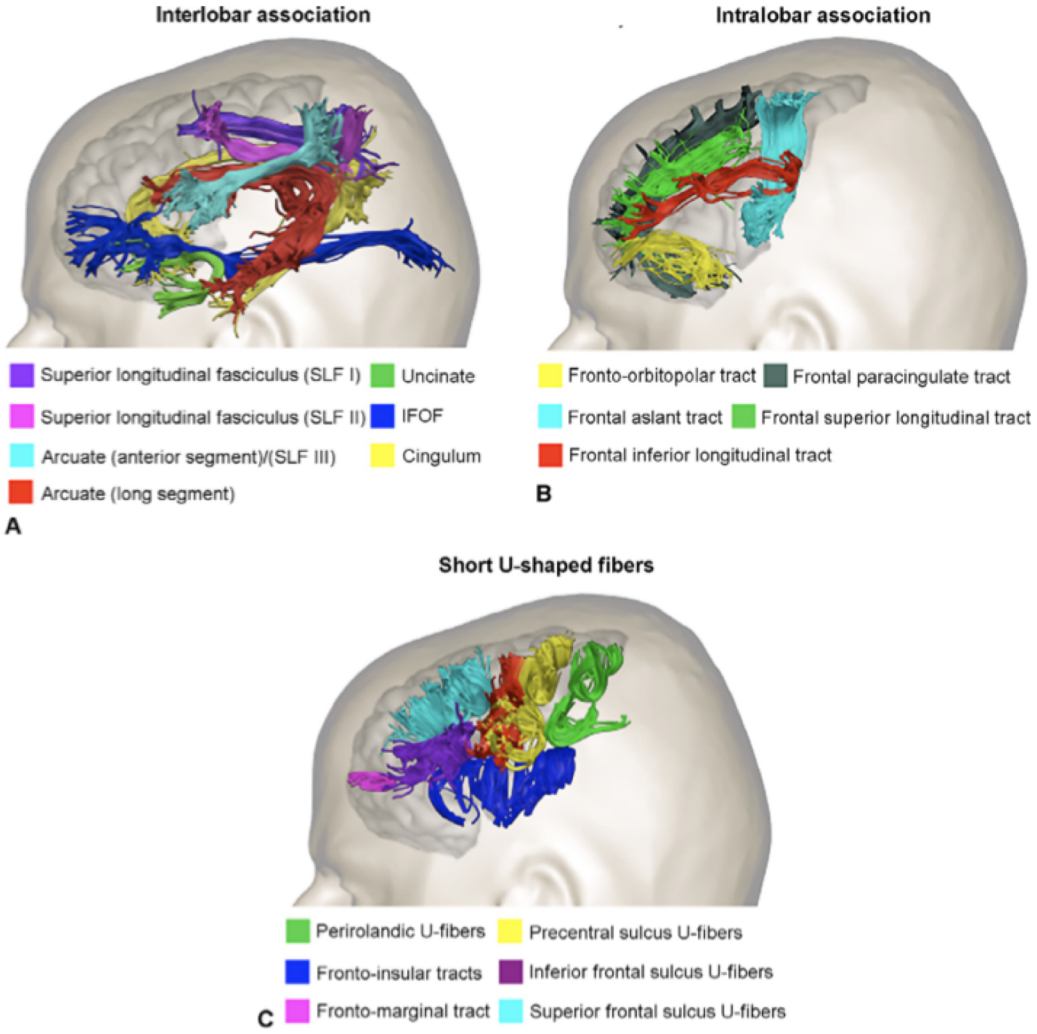




Li et al., 1994)

Anatomy and physiology (4)

Tractography reconstruction of the frontal association tracts



ELSEVIER

Handbook of Clinical Neurology
Volume 163, 2019, Pages 95-122

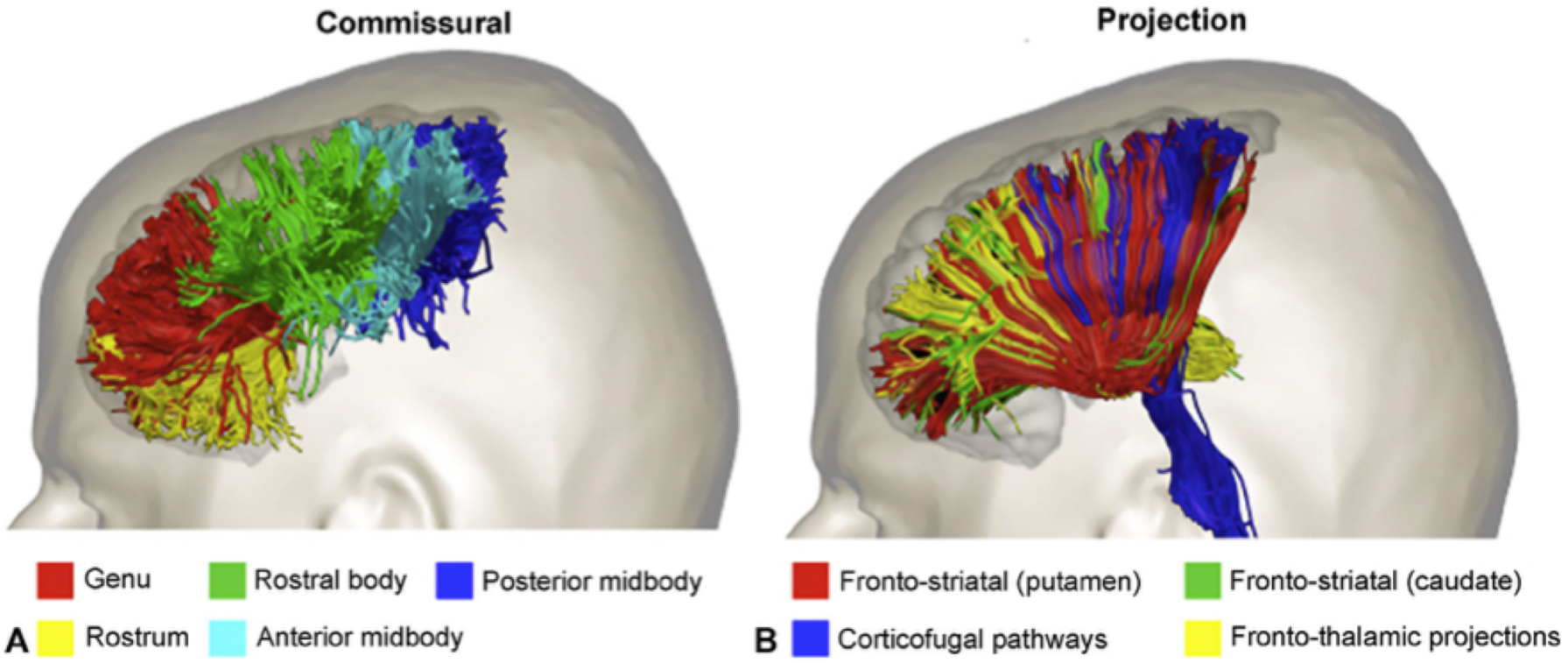
Chapter 6 - The anatomy of the human frontal lobe

Marco Catani

NatBrainLab, Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom

Anatomy and physiology (5)

Diagram of the main frontal lobe regions and their association and projection pathways.



ELSEVIER
Handbook of Clinical Neurology
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Chapter 6 - The anatomy of the human frontal lobe

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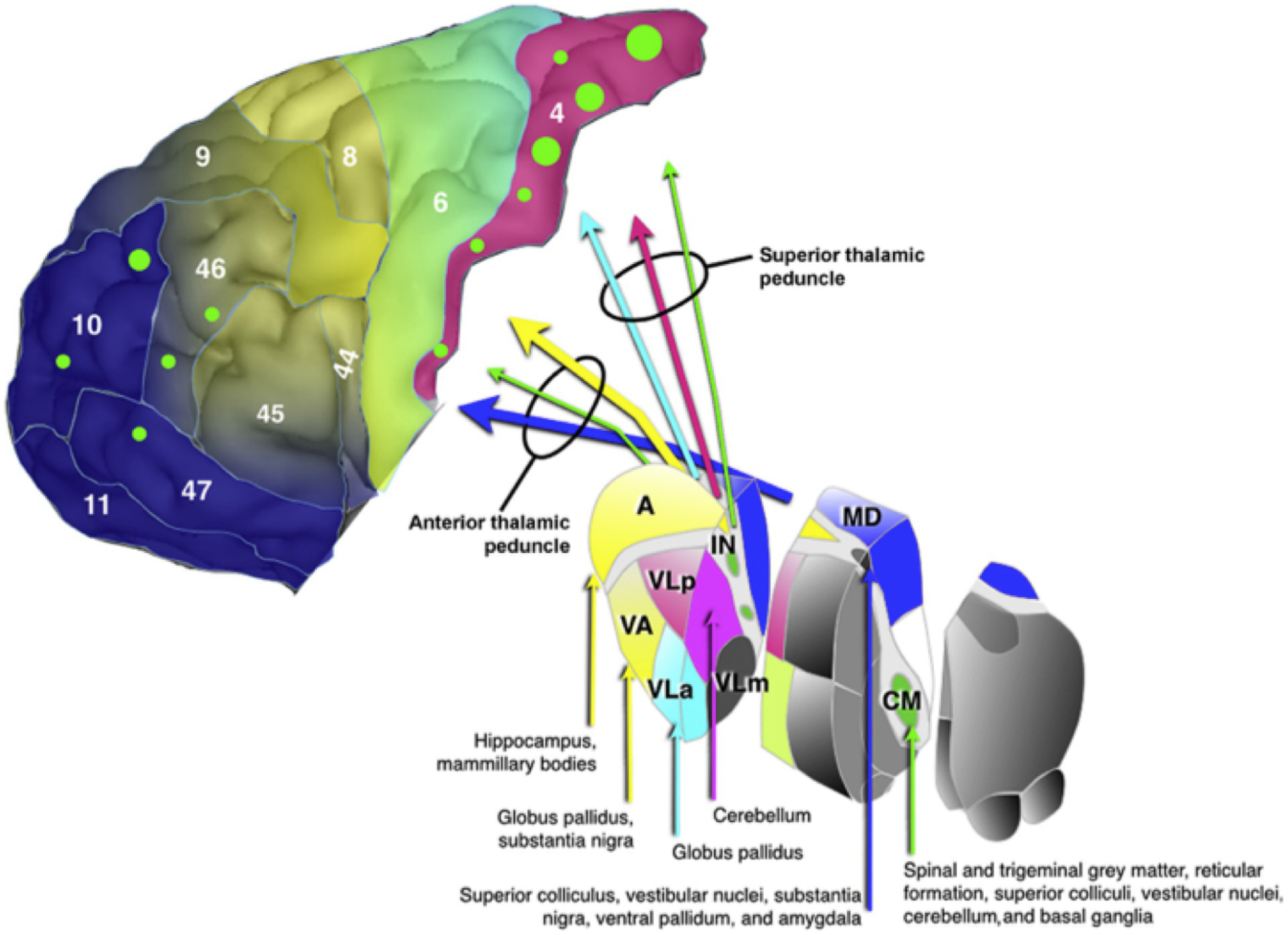
Anatomy and physiology (6)

Diagram of the principal thalamic nuclei, their afferent fibres, and their projections to the frontal cortex



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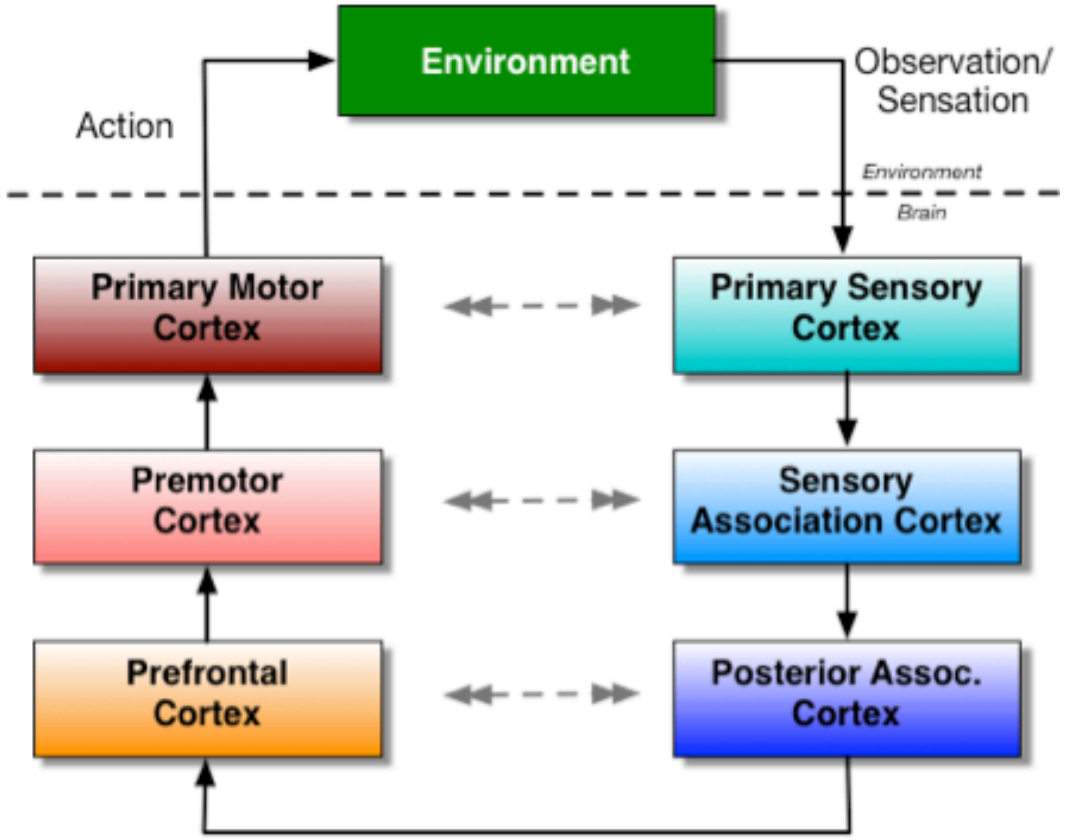
Anatomy and physiology (7)

Control of movement: schematic diagram

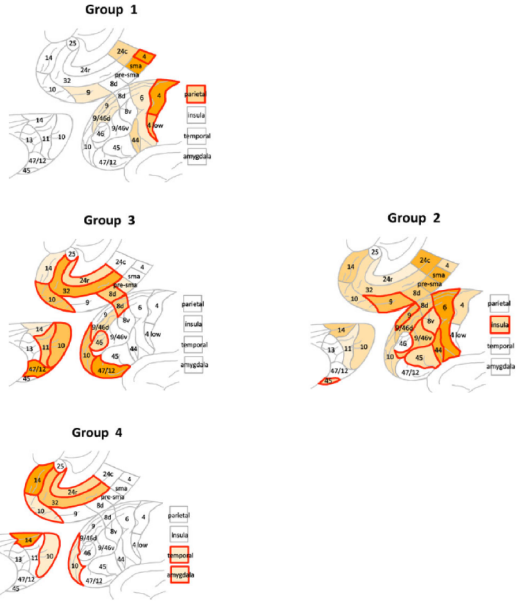



FULL-LENGTH ORIGINAL RESEARCH

Frontal lobe seizures: From clinical semiology to localization

*†[1]Francesca Bonini, *†‡[1]Aileen McGonigal, *†‡Agnès Trébuchon, *†‡Martine Gavaret, *†‡Fabrice Bartolomei, *†§Bernard Giusiano, and *†‡Patrick Chauvel

Epilepsia, 55(2):264–277, 2014
doi: 10.1111/epi.12490



(Bonini et al., 2014)

The Epileptogenic Zone and AEC correlations (1)

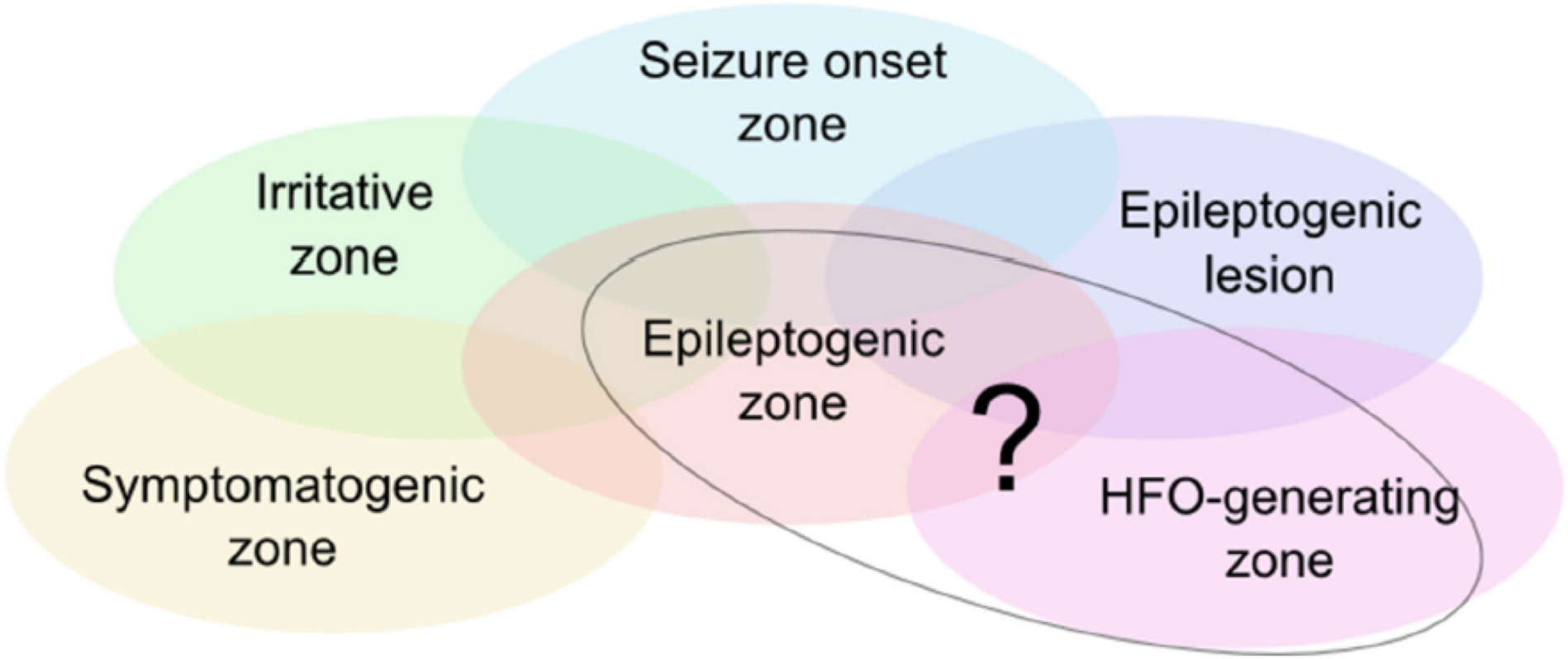
frontiers in Human Neuroscience
ORIGINAL RESEARCH
published: 20 October 2015
doi: 10.3389/fnhum.2015.00574

High-frequency oscillations in epilepsy and surgical outcome. A meta-analysis

Yvonne Höller[1], Raoul Kutil[2], Lukas Klaffenböck[2], Aljoscha Thomschewski[1], Peter M. Höller[1], Arne C. Bathke[3], Julia Jacobs[3], Alexandra C. Taylor[1], Raffaele Nardone[1,4] and Eugen Trinka[1]*

- Motor signs are frequent in seizures involving frontal cortical areas
- Ictal motor signs often do not necessarely coincide with the function
- Ictal semiology reflects the origin and 3D propagation of the discharge to areas both close to and remote from its origin
- Seizure onset zone often do not coincide with symptomatogenic zone
- Do not think in terms of a «naval battle» but in terms of AEC correlations

The Epileptogenic Zone and AEC correlations (1)



frontiers in Human Neuroscience
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The Epileptogenic Zone and AEC correlations (2)

Frontal lobe seizures

Distant cortico-cortical efferent pathways, multilobar and multidirectional

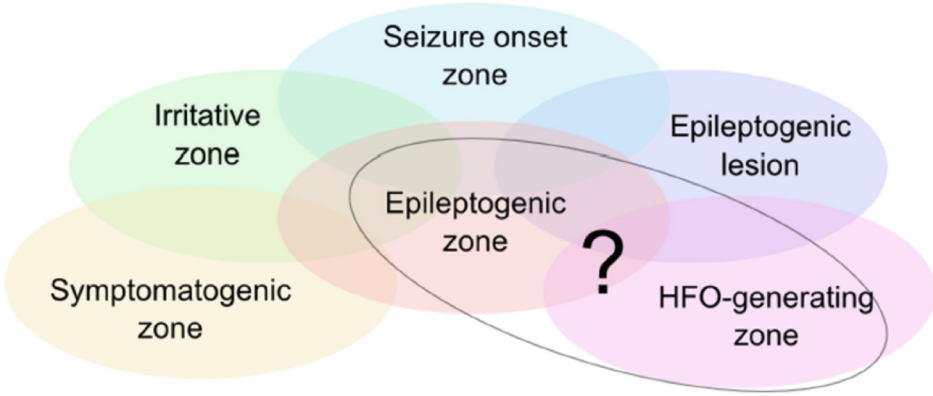
↓

Rapid, widespread propagation of seizure discharges

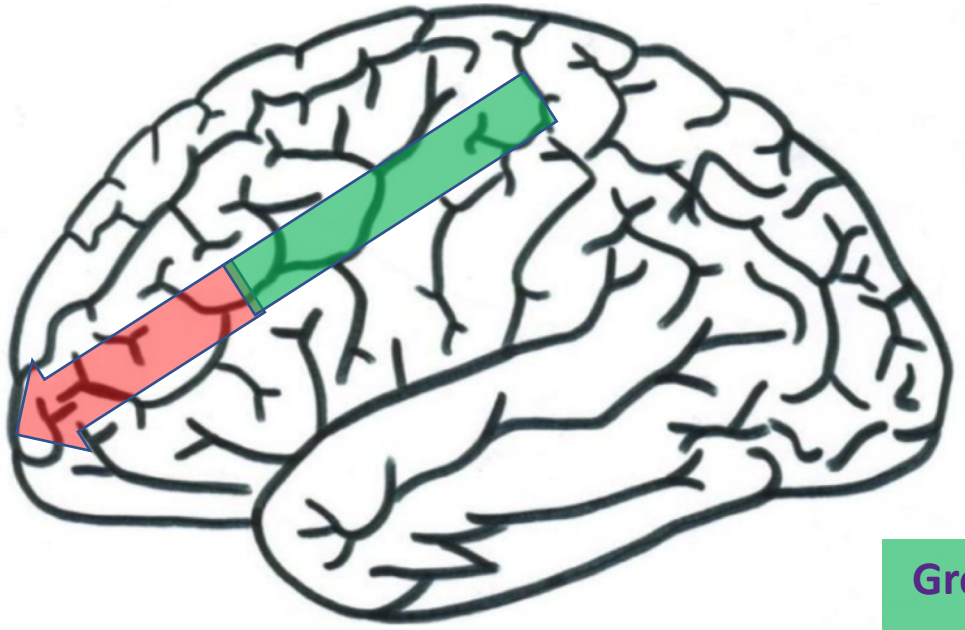
↓

Semiologic complexity

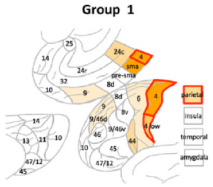
Difficulties in EEG analysis (ventromedial prefrontal region far from EEG electrodes)



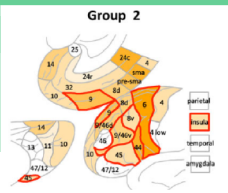
Frontal lobe seizures: From clinical semiology to localization (1)



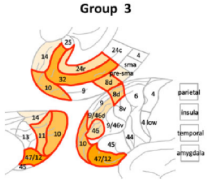
Group 1 Elementary motor signs



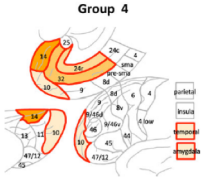
Group 2 Elementary motor signs and non integrated gestural motor behavior



Group 3 Integrated gestural motor behavior with distal stereotypies



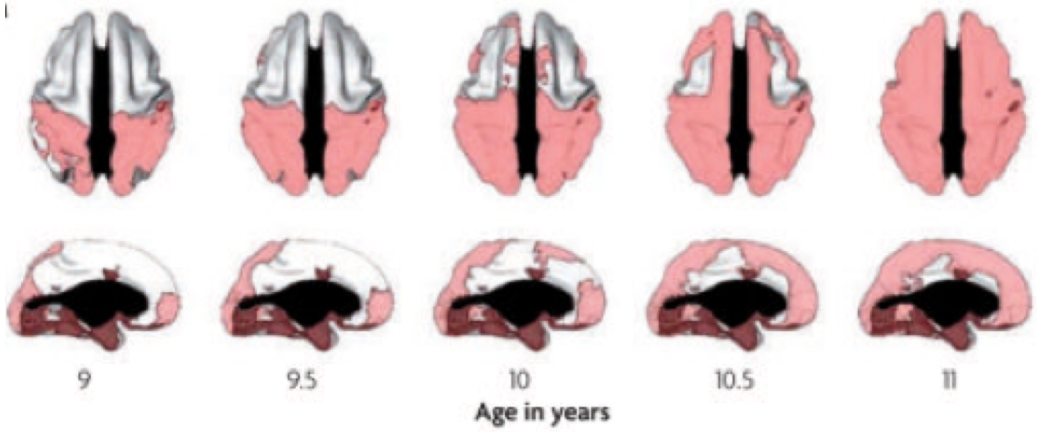
Group 4 Fearful behavior

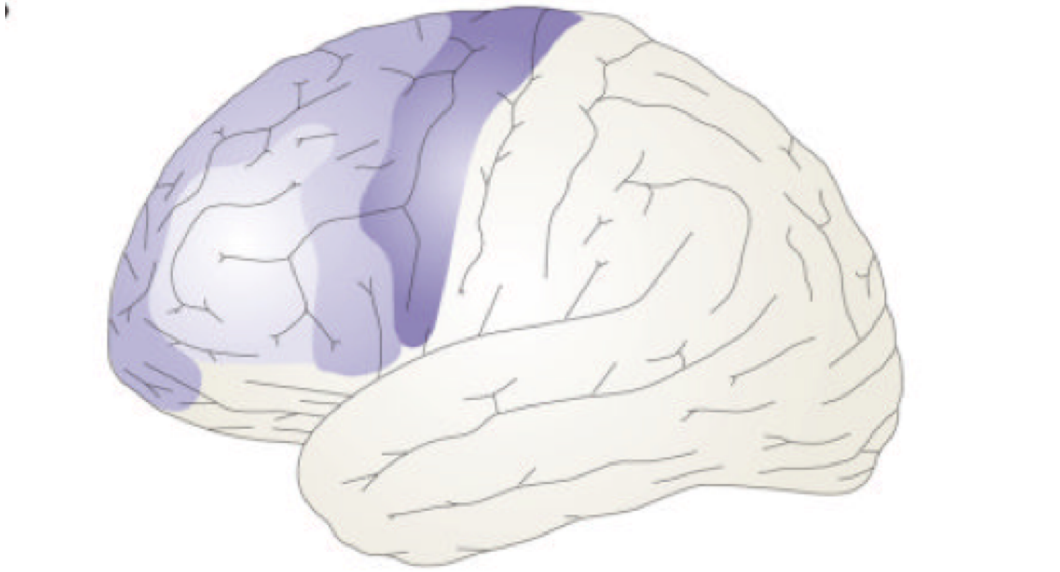


(Bonini et al., 2014)

Frontal lobe seizures: From clinical semiology to localization (2)

Development of the FLs along the rostro-caudal axis





Nat Rev Neurosci. 2009 September ; 10(9): 659–669. doi:10.1038/nrn2667.

Is the rostro-caudal axis of the frontal lobe hierarchical?

David Badre[*,‡] and **Mark D'Esposito**[||,§]

[*]Department of Cognitive & Linguistic Sciences, Brown University, Providence, Rhode Island 02912, USA

[‡]Department of Psychology, Brown University, Providence, Rhode Island 02912, USA

[§]Helen Wills Neuroscience Institute, University of California, Berkeley 94720, USA

[||]Department of Psychology, University of California, Berkeley 94720, USA

Temporal differentiation in maturation

↓

Functional differences along the rostro-caudal axis.

Lateralization value of ictal signs

Brain (2001), **124**, 1683–1700

INVITED REVIEW

Presurgical evaluation of epilepsy

Felix Rosenow[1] and Hans Lüders[2]

Table 2 *Lateralizing ictal and postictal symptoms in patients with temporal lobe or extratemporal epilepsy*

Symptom	Location of the epileptogenic zone	Specificity	Frequency	References
Forced head-version (<10 s) before secondary generalization	Contralateral	>90%	TLE 35% ETE 40%	Wyllie *et al.*, 1986 Kernan *et al.*, 1993 Bleasel *et al.*, 1997 Chee *et al.*, 1993
Unilateral ictal dystonia	Contralateral	90–100%	TLE 35 % ETE 20%	Kotagal *et al.*, 1989 Steinhoff *et al.*, 1998 Bleasel *et al.*, 1997
Ictal speech	Non-dominant	>80%	10–20%	Chee *et al.*, 1993
Preserved consciousness during ictal automatisms	Non-dominant	100%	Rare, 5%	Ebner *et al.*, 1995
Postictal dysphasia	Dominant	>80%	20% (depends on the testing)	Steinhoff *et al.*, 1998 Chee *et al.*, 1993
Postictal nosewiping	Ipsilateral	80–90%	TLE 40–50% FLE 10%	Geyer *et al.*, 1999 Hirsch *et al.*, 1998 Leutmezer *et al.*, 1998
Unilateral eyeblinking	Ipsilateral	80%	Rare, 1.5%	Benbadis *et al.*, 1996
Ictal vomiting	Non-dominant	>90%	Rare	Kramer *et al.*, 1988
Figure of four	Contralateral	90%	65% of patients with sGTCSs	Kotagal *et al.*, 2000

ETE = extratemporal epilepsy; FLE = frontal lobe epilepsy; sGTCSs = secondary generalized tonic–clonic seizures; TLE = temporal lobe epilepsy.

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Lateralization value of ictal motor signs

Table 4: Important semiologic features and their lateralizating and/or localizing value

Semiologic features	Lateralization and/or localization
3- Motor abnormalities	
Early nonforced head turn	Ipsilateral to seizure origin
Late forced head turn	Contralateral to seizure origin
Eye deviation	Contralateral to seizure origin
Focal clonic jerking	Contralateral to seizure origin, peri-rolandic
Asymmetric clonic ending	Ipsilateral to seizure origin
Dystonic limb posturing	Contralateral to seizure origin
Tonic limb posturing	Contralateral to seizure origin
Fencing posture	Contralateral frontal lobe (supplementary motor) seizures
Figure of 4 sign	Contralateral to the extended limb, usually temporal lobe
Unilateral ictal paresis	Contralateral to seizure origin
Postictal Todd's paresis	Contralateral to seizure origin

REVIEW ARTICLE

Seizure Semiology: Value in Identifying Seizure Origin

Mohammed M.S. Jan, John P. Girvin

Can. J. Neurol. Sci. 2008; 35: 22-30

not always **contralateral**

Automatisms → Unilateral clonic seizure

More or less regular, repeated, **short contractions of various muscle groups** (0.2-5 Hz).

Distal part of the extremities or face and most probably originate from the **primary motor or premotor area.**
(Noachtar and Arnold, 2000)

In contrast, **in TLE**, **clonic seizures typically occur after automatisms** (spread of epileptic activity from the temporal to the frontal lobe).

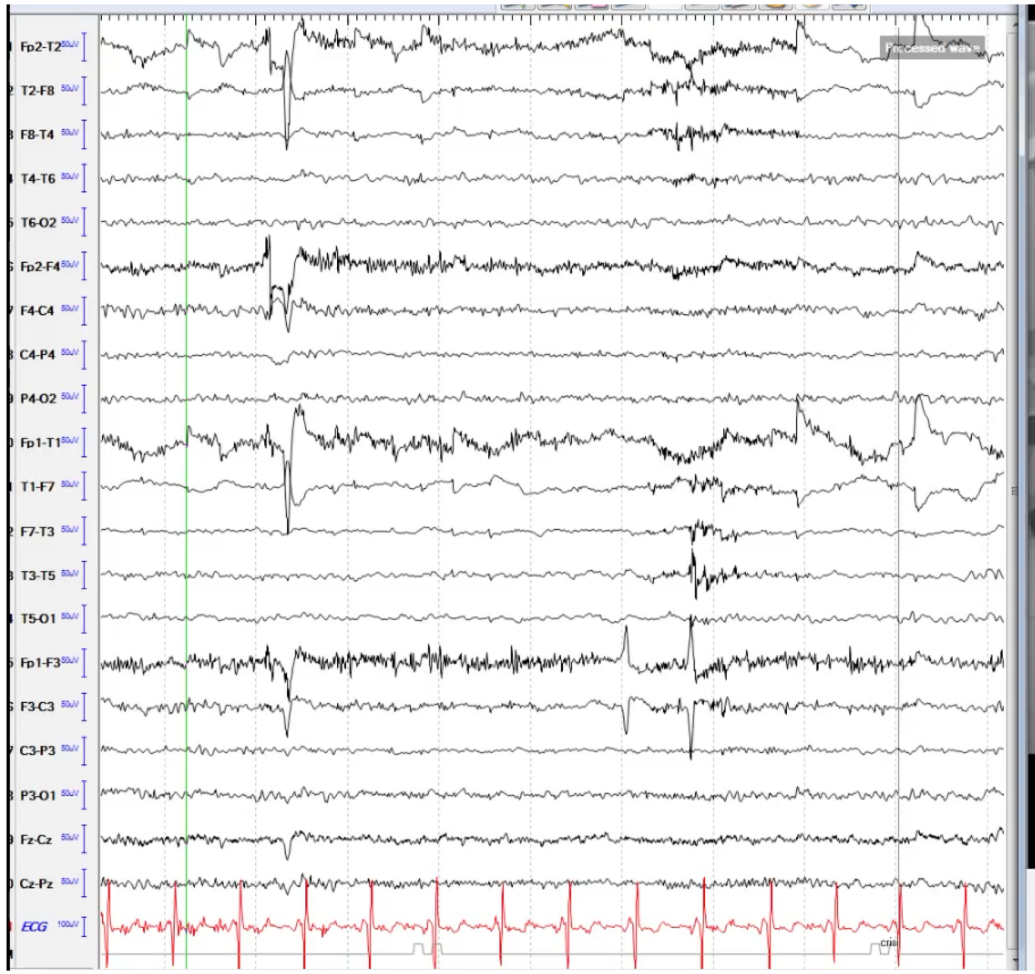
Positive predictive value of 92% for seizure onset in the **contralateral hemisphere** (Janszky et al., 2001).

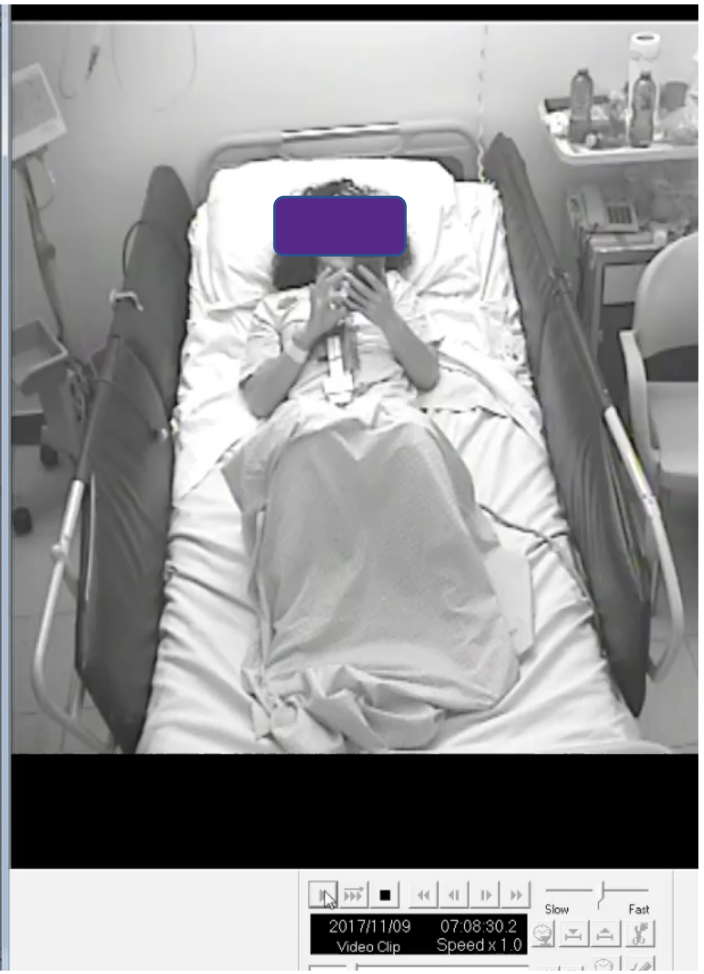
Automotor seizure → Clonic seizure of the left side of the face

A 44-year-old woman with right neocortical TLE of unknown origin. EEG seizure onsets were localised to the right posterior temporal region.

(Stoike et al., 2010)

Dx unilateral gestural automatisms





Left TLE-HS

↓

Left ATL

↓

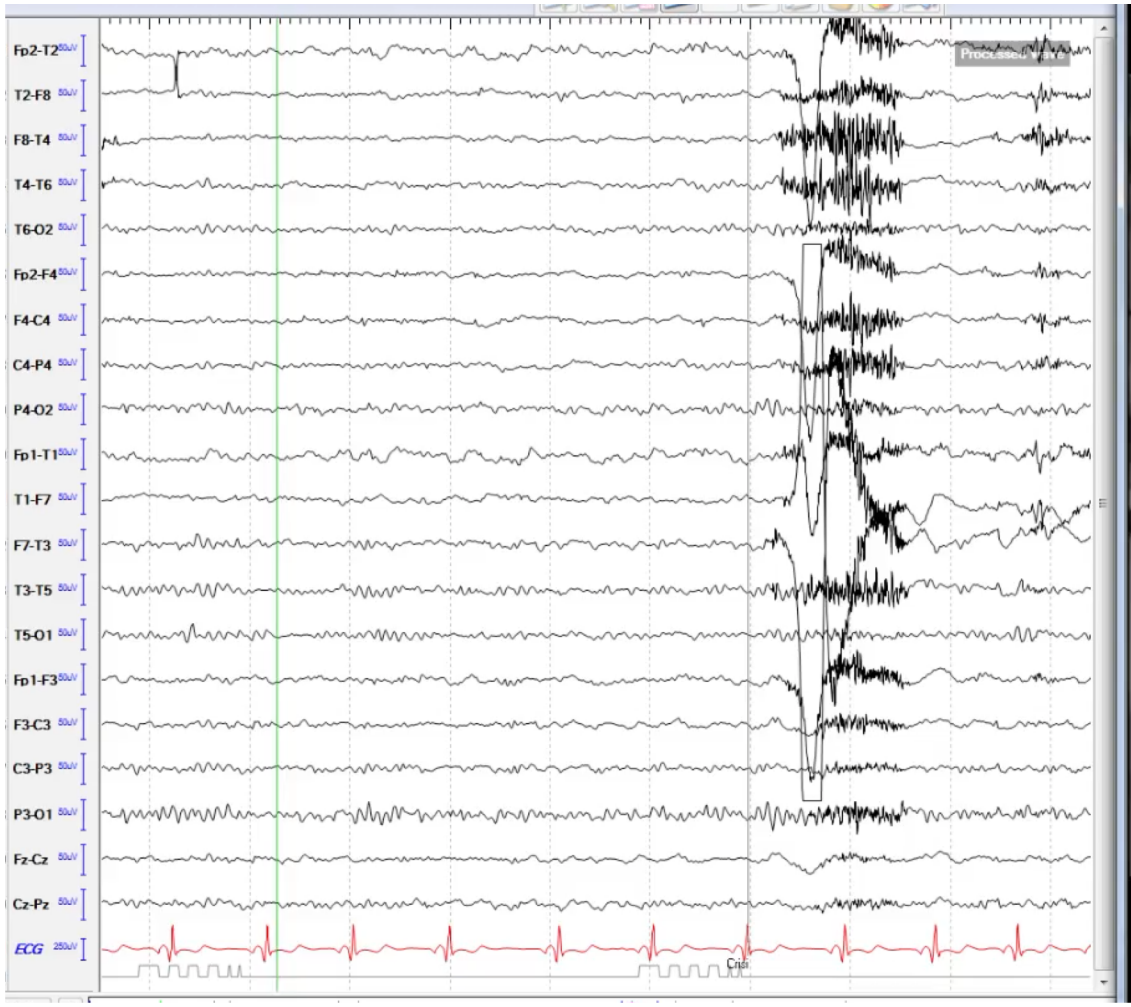
Long-term Engel Class IA

Epileptic negative myoclonus/Epilepsia partialis continua

- Short (ca. 30-400 ms) phases of **muscle atonia (**clinically observed only **during muscle contraction)** (Tassinari and Gastaut, 1969).
- Focal negative motor phenomena frequently **preceded by epileptiform discharges in the contralateral central region** (20-30 ms before atonia).
- Origin in **primary somatosensorimotor cortex** (Ikeda et al., 2000), the **premotor cortex** (Baumgartner et al., 1996, Meletti et al., 2000) and the **postcentral cortex** (Noachtar et al., 1997)

(Stoike et al., 2010)

Unilateral tonic seizure+ head/body rotation (2)



Bilateral tonic facial contraction (ictal pouting or «chapeau du gendarme») (1)

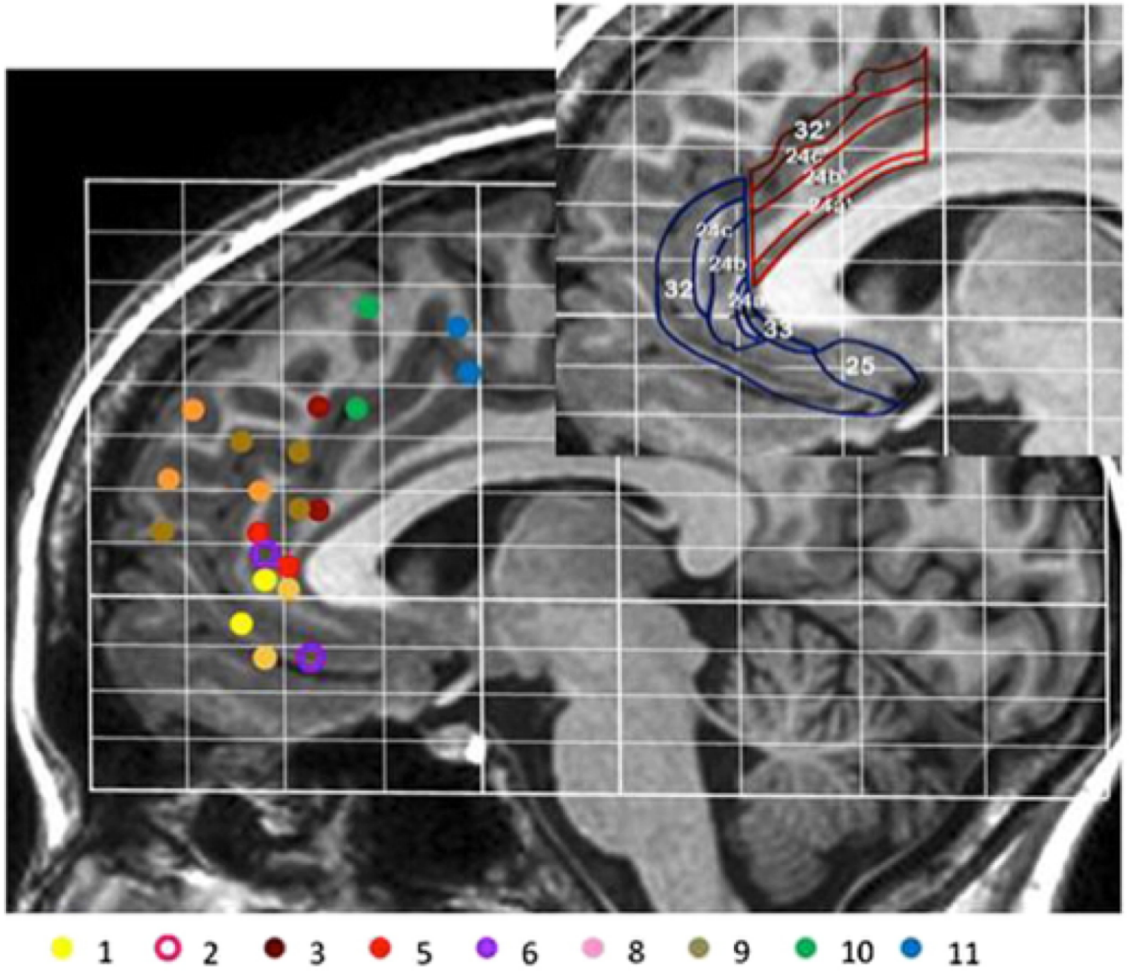
- Symmetrical and sustained (> 5 s) **lowering of labial commissures** with contraction of chin, mimicking an expression of fear, disgust, or menace

- Early symptom in frontal seizures

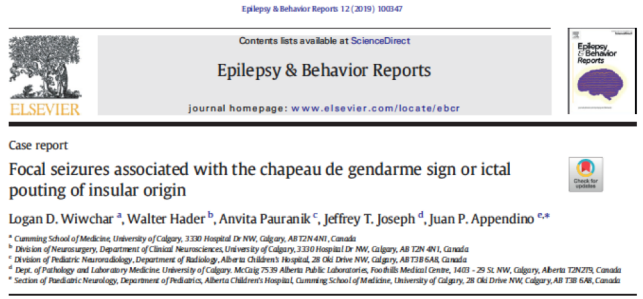
- PET-FDG hypometabolism include both the **anterior cingulate cortex and lateral cortex including the anterior insula** in all cases.

(Souirti et al., 2010)

Bilateral tonic facial contraction (ictal pouting or «chapeau du gendarme») (2)



ACC primary involvement	ACC secondary involvement
Emotional expression Hypermotor behavior Open eyes, staring **Rostral-ventral ACC** **(rostral part of areas 24, 32, ventral areas 25,33)**	Disgust **Inferior frontal gyrus** ↓ **Anterior INSULA**
Absence of emotional expression Closed eyes **Dorsal ACC** **(dorsal part of areas 24, 32)**	↓ **Central OPERCULUM** Subcortical structures?


Epilepsy & Behavior Reports 12 (2019) 100347

Contents lists available at ScienceDirect

Epilepsy & Behavior Reports

journal homepage: www.elsevier.com/locate/ebcr

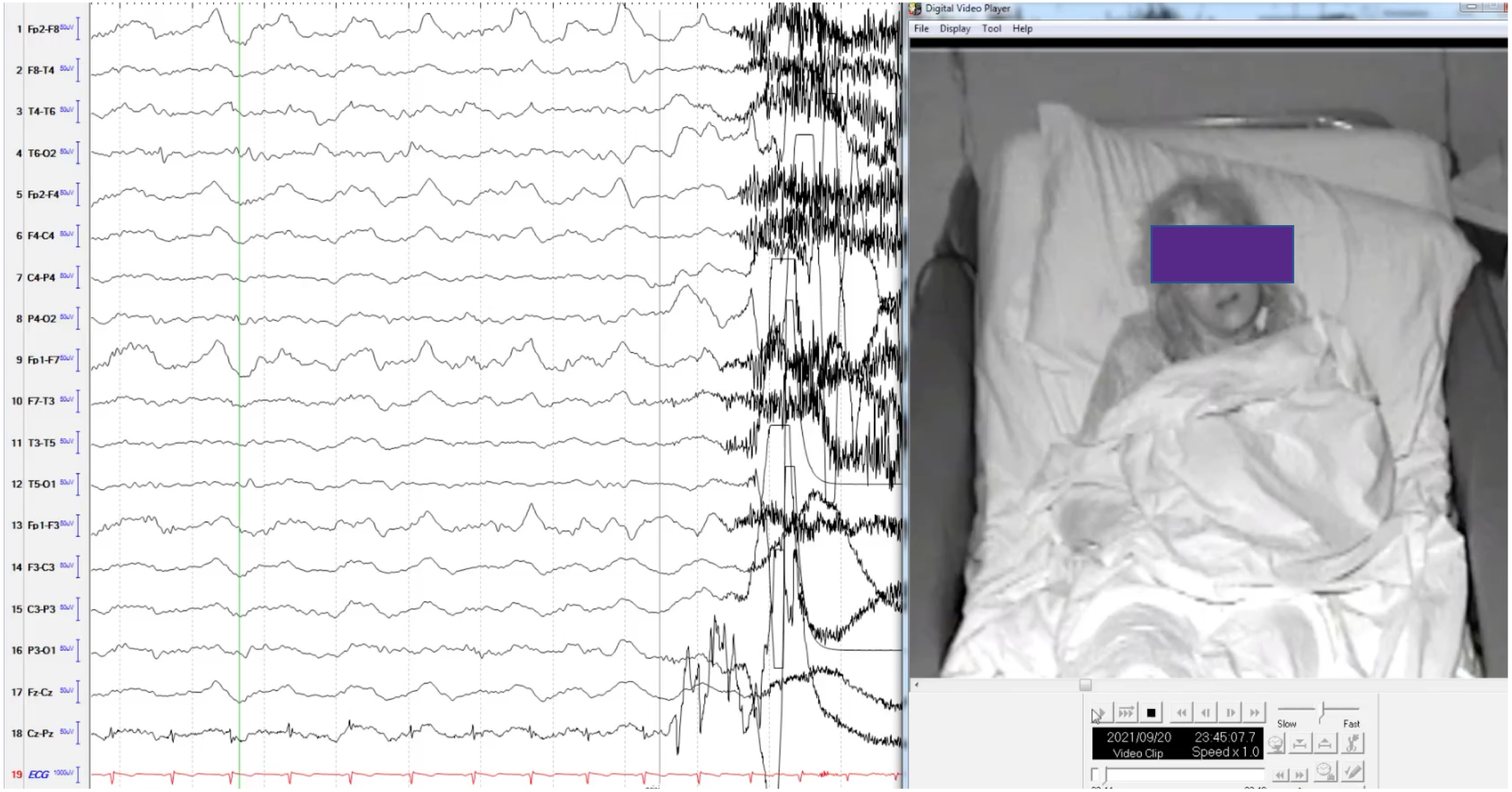
Case report

Focal seizures associated with the chapeau de gendarme sign or ictal pouting of insular origin

Logan D. Wiwchar [a], Walter Hader [b], Anvita Pauranik [c], Jeffrey T. Joseph [d], Juan P. Appendino [e,*]

(Wiwchar et al., 2019)

Dx vs paroxysmal hypnogenic/non kinesigenic dyskinesia (1)



Dx vs paroxysmal hypnogenic/non kinesigenic dyskinesia (2)

Table 1. Demographic and clinical features in paroxysmal dyskinesias.

Feature	PKD	PNKD	PED	PHD
Age at onset (years)	5–15 (range: 0.5–33)	8 (range: 2.5–79)	5 (range: 2–30)	Adolescence (range: 2–47)
Sex (male:female ratio)	4:1 (even up to 8:1)	2:1	2:3	1:1
Predominant movement	Dystonia >> chorea, ballism or a combination	Dystonia and chorea	Dystonia	Dystonia, chorea or ballism
Duration	<1 minute (seconds–5 min)	<1 hour (10 min–12 h)	2 min–2 h	30–45 seconds
Frequency	1–20 attacks per day	1 per week (3 per day)	1 per day–2 per month	5 per night–5 per year
Aura	70%	80% familial cases	No	–
Distribution	Limbs >> trunk and face	Face, trunk and limbs	Feet >> hemidystonia and hands	Limbs >> trunk and face
Triggers	Abrupt movement, an increase of speed, amplitude or strength. Light, sound and vestibular stimulation, startle, hyperventilation and stress	At rest; alcohol, coffee, tea, cola, tobacco, emotional excitement, hunger, fever, concentration and fatigue	Prolonged or maintained exercise; vibration, passive movements, electrical stimulation of the nerves, stress, hunger, sleep deprivation, cold exposure	Non-REM sleep
Exacerbating factors	Puberty, depression and anxiety	Menstruation, ovulation and postpartum	–	–
Response to antiepileptic drugs	+++	+/–	++ ('runner's dystonia')	+++
Evolution	Remission: pregnancy and adulthood	Variable; remission: pregnancy, sleep, cold water, the elderly, menopause	Variable; remission: sensory or motor 'tricks' ('runner's dystonia')	-

PED: Paroxysmal exercise-induced dyskinesia; PHD: Paroxysmal hypnogenic dyskinesia; PKD: Paroxysmal kinesigenic dyskinesia; PNKD: Paroxysmal nonkinesigenic dyskinesia.

Calderon, 2019

Bilateral tonic seizure (SSMA vs Extra-SSMA)

SSMA group

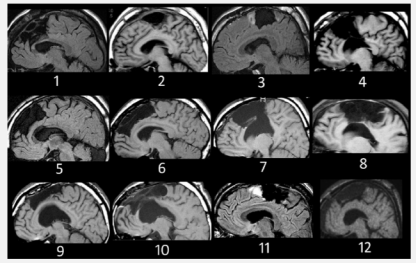
- Unilateral/ bilateral **asymmetrical** tonic limb posturing (**extended** upper extremity was **contralateral** and flexed upper extremity was ipsilateral)
- **Awareness** during seizures was **preserved**
- Often **aura** and more than half of the auras were **somatosensory** (seven patients). Side of somatosensory aura was **contralateral**
- **Bilateral tonic facial contraction** (BTFC) and speech arrest are **frequent**

Extra SSMA group

- Bilateral symmetrical tonic limb posturing
- Impaired awareness during seizures

SSMA group 22 pts

Extra-SSMA group 10 pts



4 dlF or preF
2 insula
3 P
1 TP

SSMA
Bilateral asymmetrical (extension contralateral)

SSMA
Bilateral tonic facial contraction

Extra-SSMA
Bilateral symmetrical)

(Sitthinamsuwan et al., 2016)

Bilateral tonic/dystonic seizure (insula → frontal lobe) (1)

- Full awareness
- Laryngeal constriction
- Paresthesiae, often unpleasant, affecting large cutaneous territories

1. Evol**ution in hyperkinetic seizure**
2. **Evolution in Bilateral tonic/dystonic seizure**

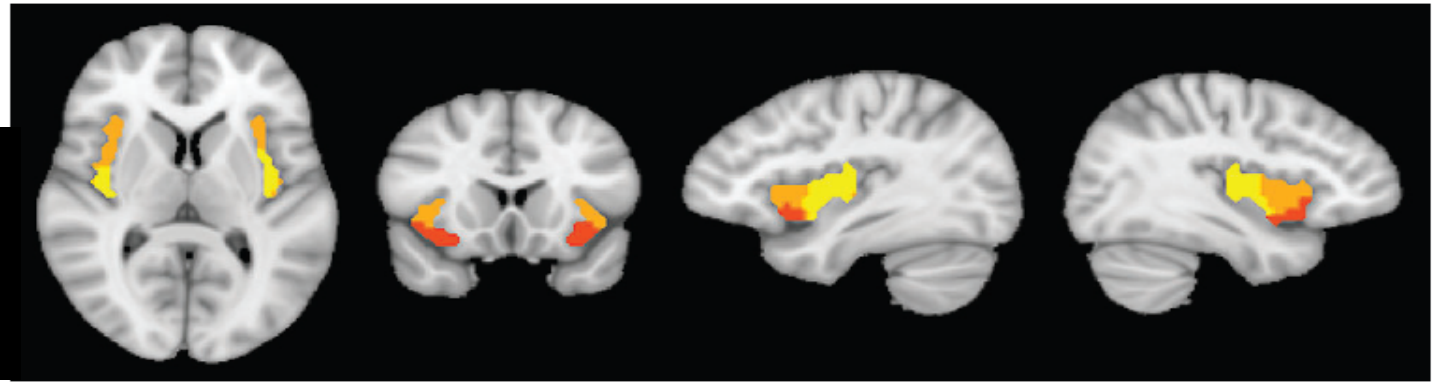
Isnard et al., 2004

Posterior antero-inferior → TLE semiology
Antero-superior → FLE semiology

Ryvlin et al., 2006

Bilateral tonic/dystonic seizure R>L

Involvement of frontal cingulate gyrus and the posterior part of the mesial frontal cortex, in particular the SSMA (Proserpio et al., 2011)



Hand posture (FLE vs TLE) (1)

RESEARCH ARTICLE

Hand Posture as Localizing Sign in Adult Focal Epileptic Seizures

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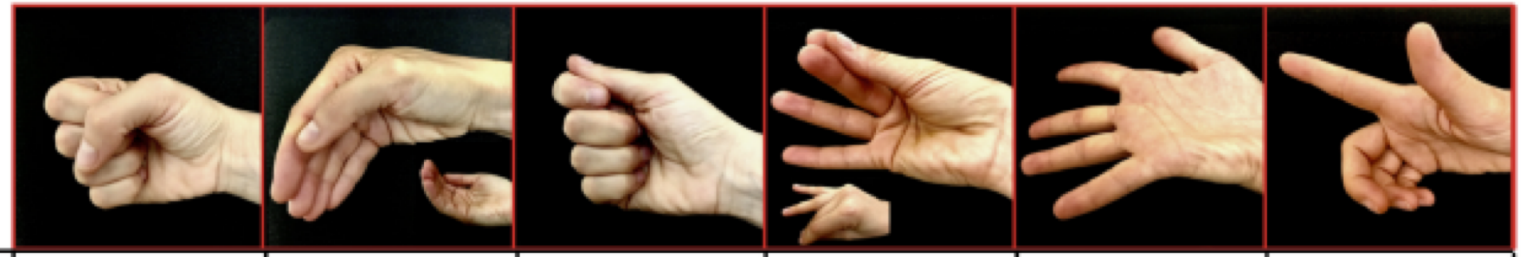


	fist	cup	politician's fist	pincer	extended hand	pointing
Thumb MP	Flexed	Flexed	Flexed	Flexed	Extended	Extended
Thumb IP	Flexed	Extended	Extended	Extended	Extended	Extended
Index MP	Flexed	Flexed	Flexed	Flexed	Extended	Extended
Index IP	Flexed	Flexed	Flexed	Flexed	Extended	Extended
3-5 MP	Flexed	Flexed	Flexed	Ext/Flex	Extended	Flexed
3-5 IP	Flexed	Flexed	Flexed	Ext/Flex	Extended	Flexed

79 pts, 489 seizures

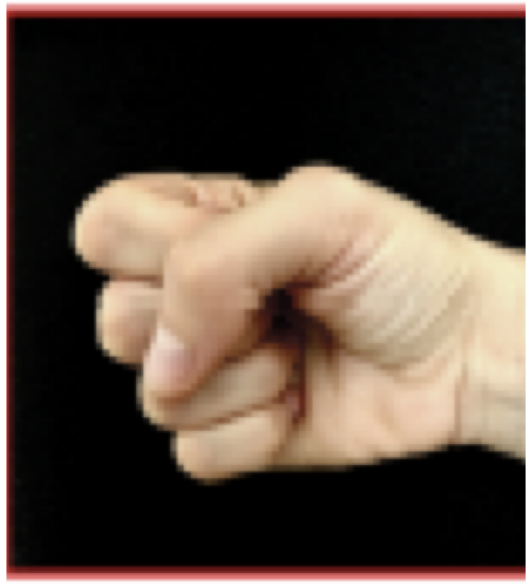
- Seizure Disorder Center
  UCLA, Los Angeles (USA)
- C. Munari Epilepsy Surgery Center
  Niguarda Hospital, Milan, Italy

(Ferando et al., 2019)

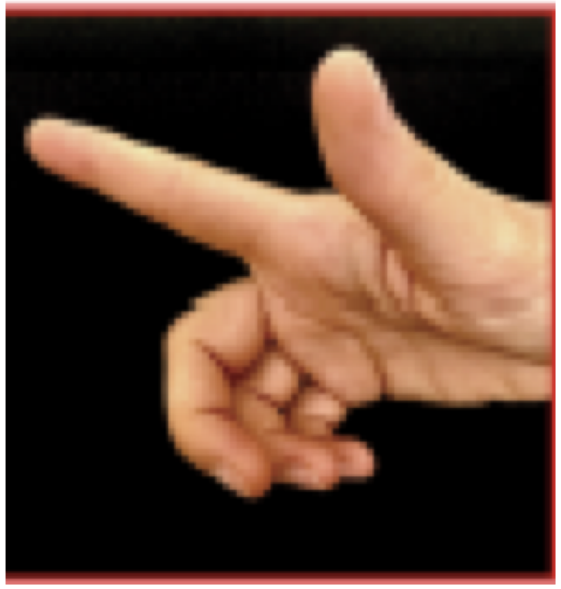
Hand posture (FLE vs TLE) (2)

100% specificity and PPV in FLE

fist



pointing

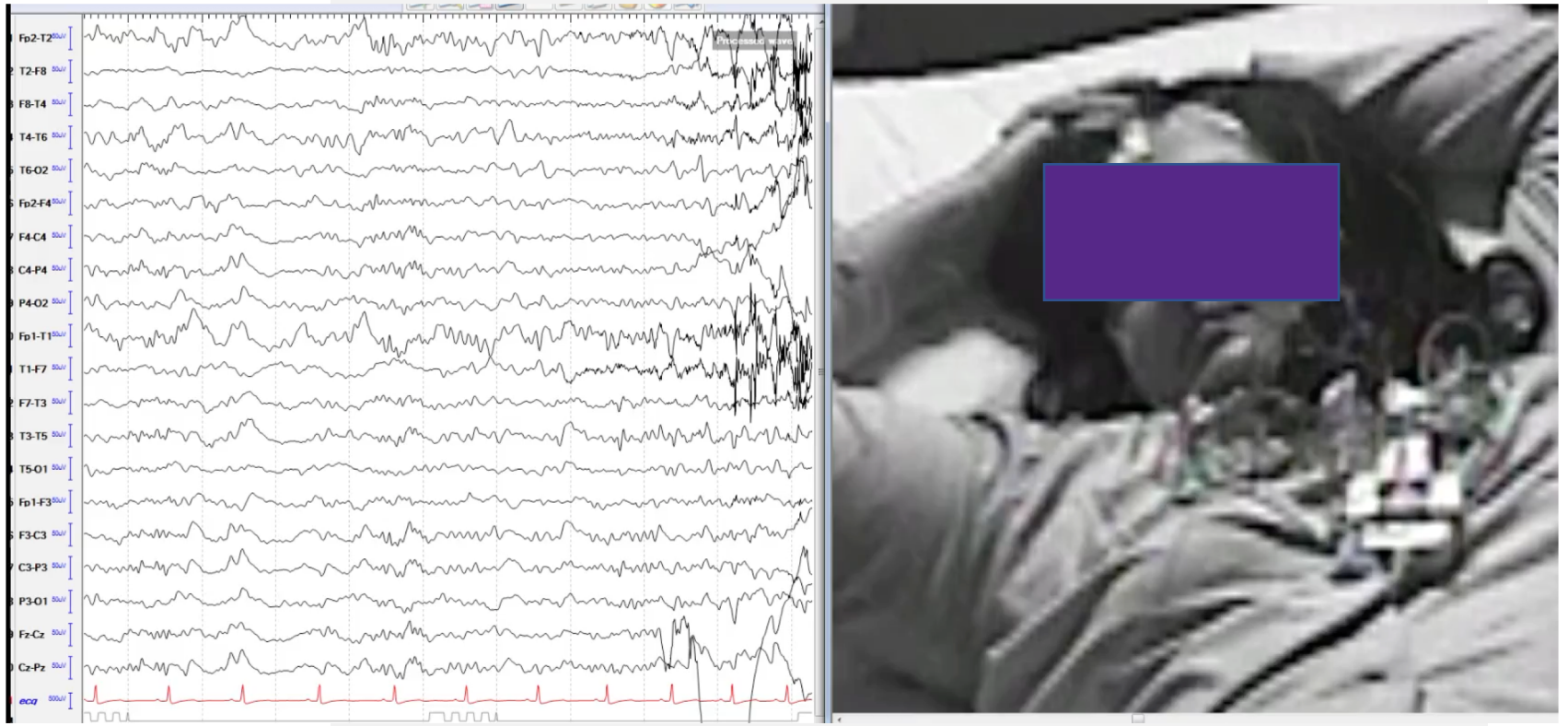


(Ferando et al., 2019)

Head and eye deviation (1)

- **Versive seizures** consist of a **forced and involuntary head movement resulting in sustained unnatural positioning** (Wyllie et al., 1986a), High specificity (>90%) of lateralisation for a c**ontralateral** seizure onset zone (Chee et al., 1993; Steinhoff et al., 1998), particularly when occurring immediately prior to generalisation (Kernan et al., 1993).

- IEpileptic **activation of the frontal eye field** contralateral to the side to which the eyes or head turn (Penfield and Jasper, 1954).



Head and eye deviation (ipsilateral/contralateral) (2)

In Frontal Lobe Seizures

Ipsilateral

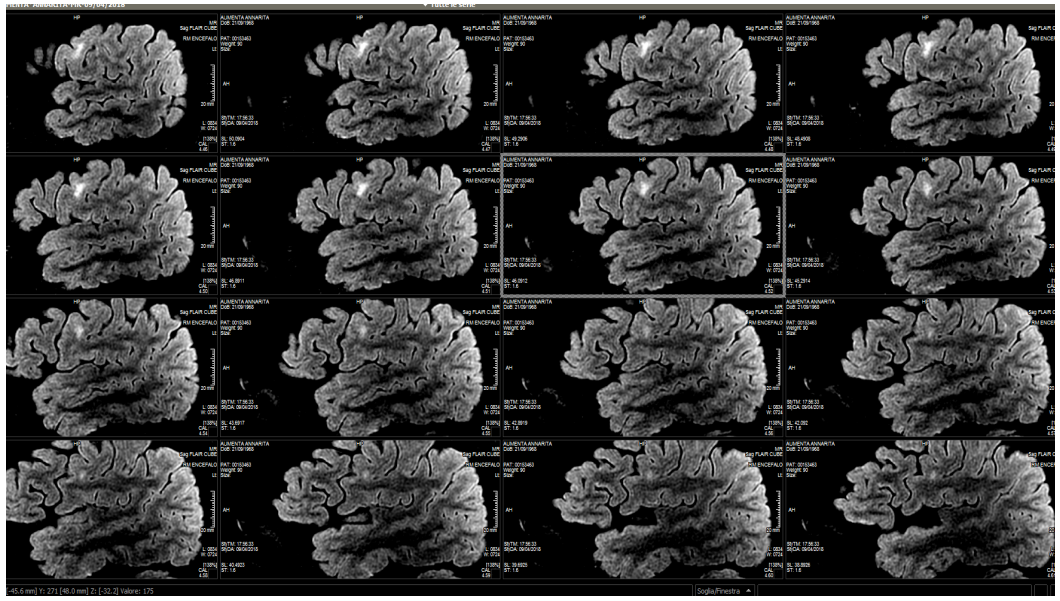
- early
- no associated clonic movements
- (frontopolar/orbitofrontal)

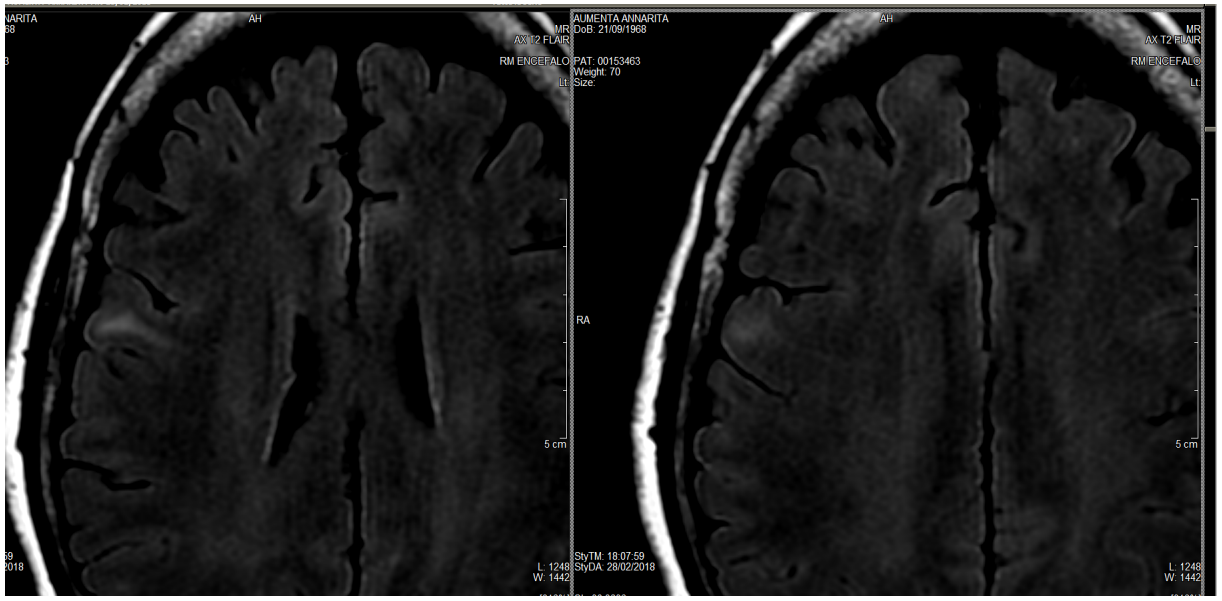
Contralateral

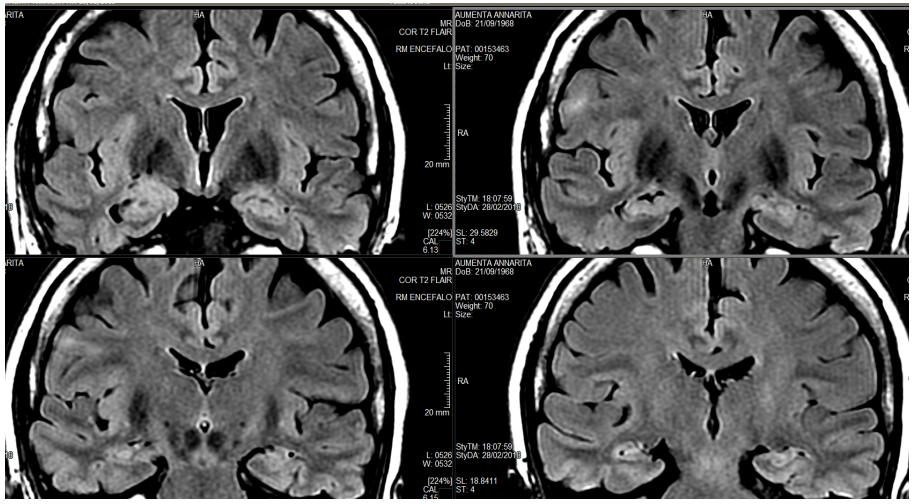
- Tardive
- Tonic unnatural
- Associated clonic moviments (FEF)

(Rheims, 2005)

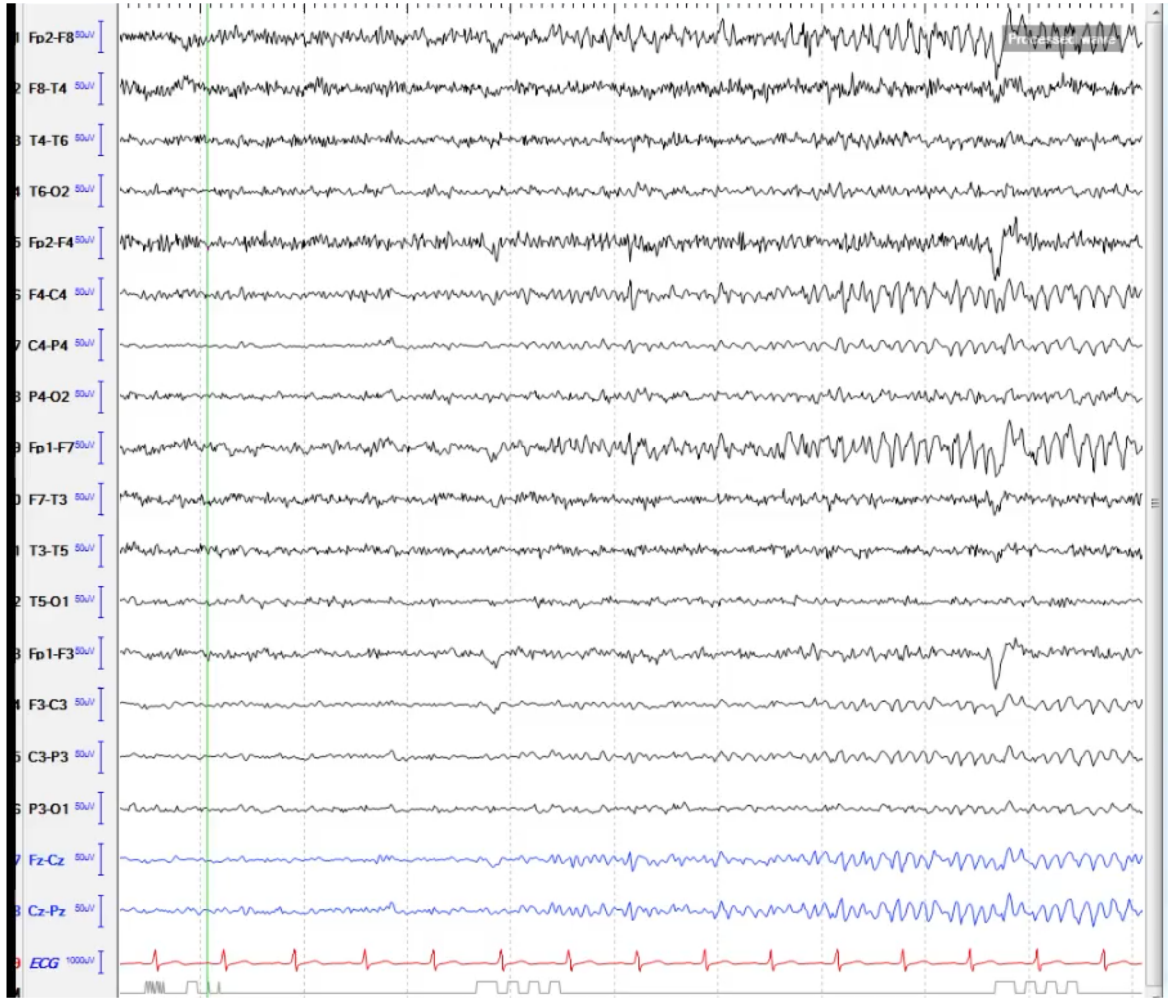
Head and eye deviation (ipsilateral/contralateral) (2)

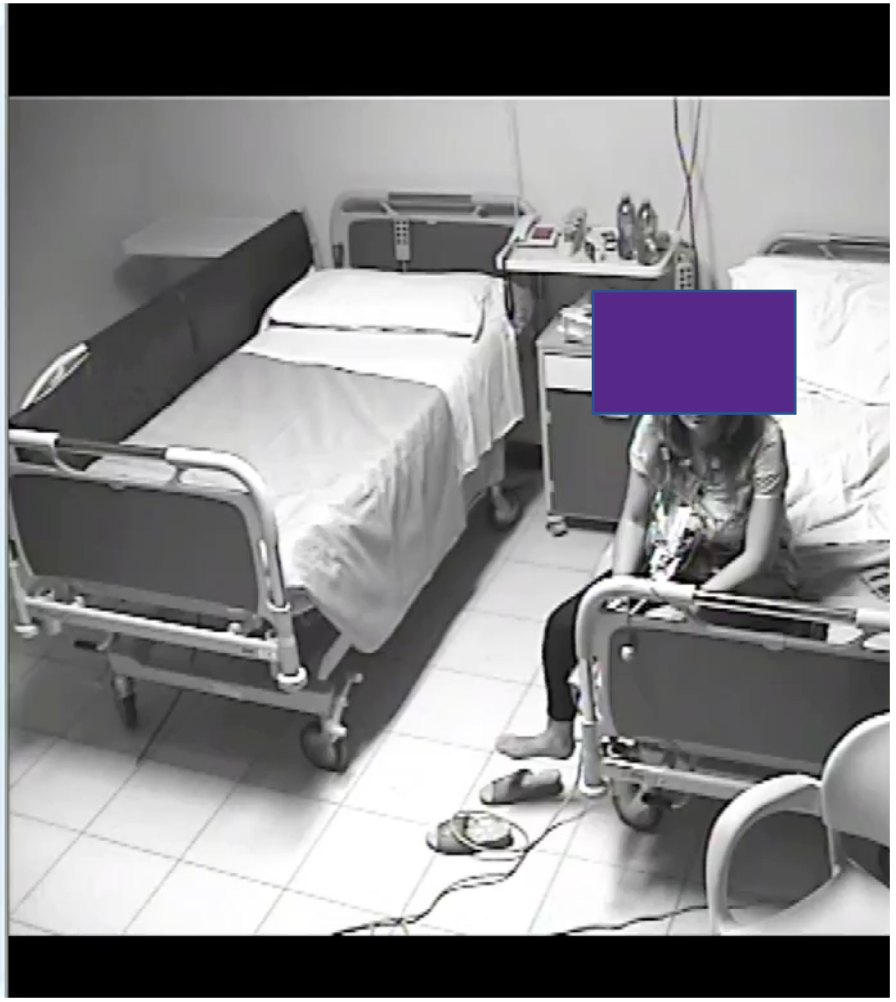




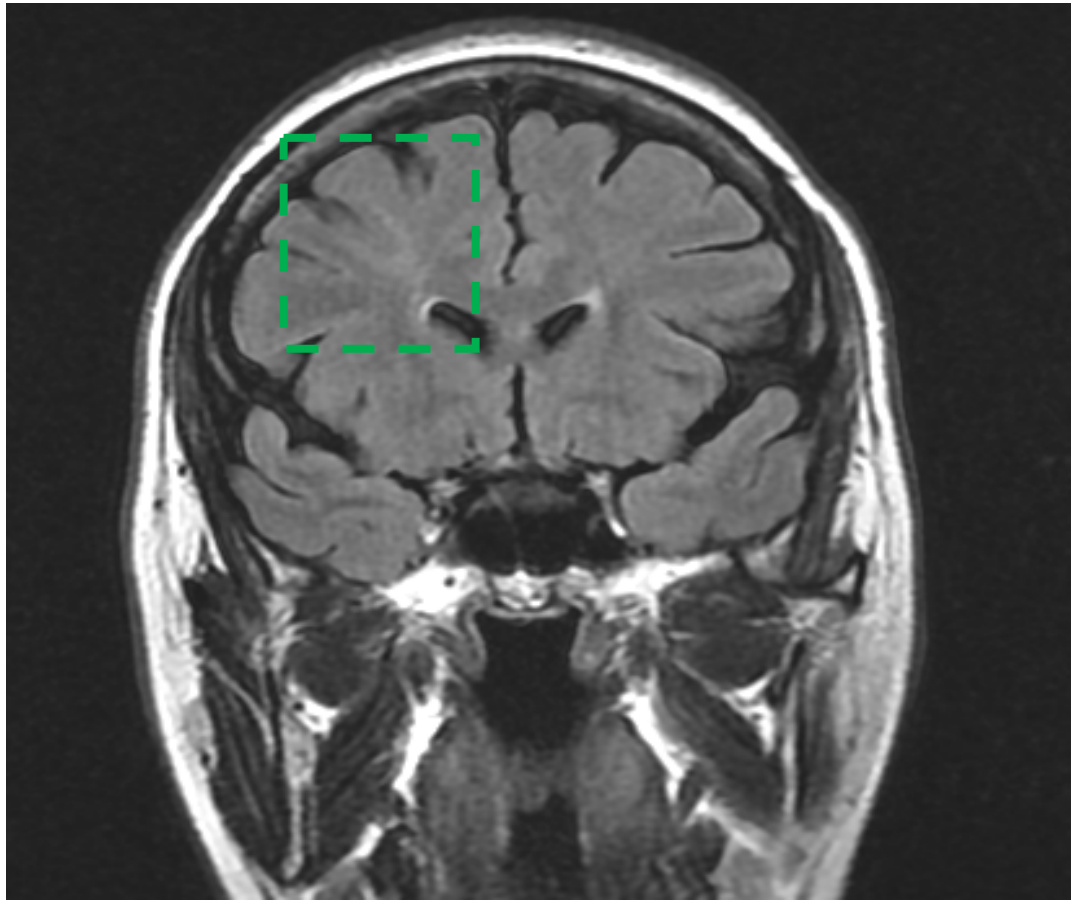


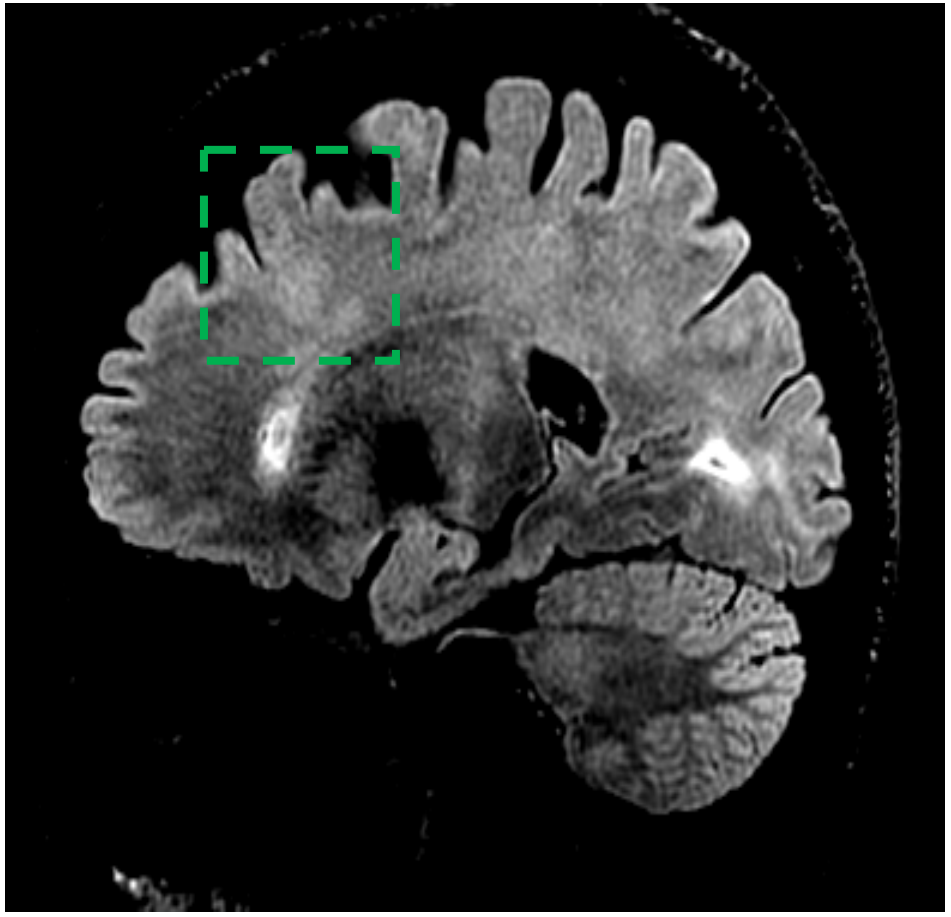
Rotatory seizures (1)





Rotatory seizures (2)





NEUROMED
I.R.C.C.S.
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Epilessia: Mettiamo in crisi il pregiudizio

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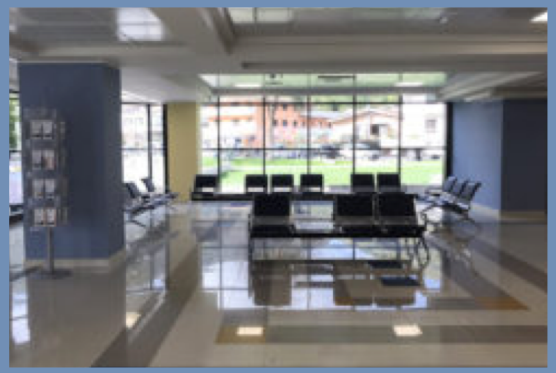

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