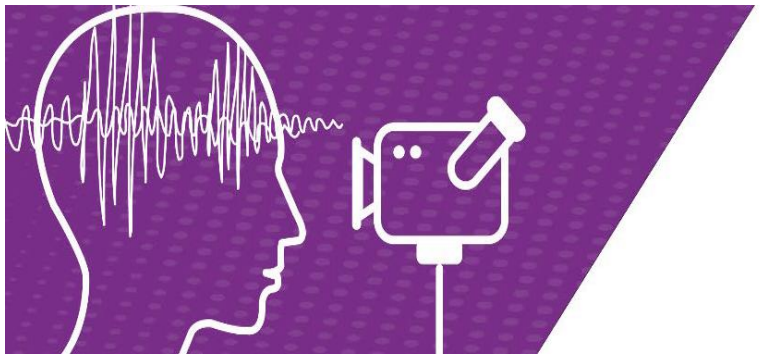


CORSO VIDEO EEG LICE
3° EDIZIONE
CATANIA, 24-27 OTTOBRE 2021

Storia dell'epilessia del lobo frontale

Prof Paolo Tinuper

Dipartimento di Scienze Biomediche e Neuromotorie. Università di Bologna.
IRCCS Istituto delle Scienze Neurologiche. Ospedale Bellaria. Bologna

assenza di conflitti di interesse

Prima dell'EEG..

Concetto pre-jacksoniano dell'epilettogenesi: i generatori delle crisi focali motorie sono a livello dei gangli della base

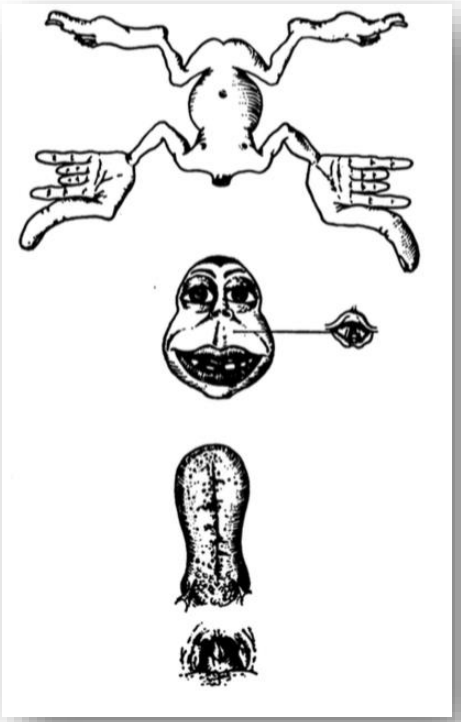
Jackson, J. H. (1863). Convulsive spasms of the right hand and arm preceding epileptic seizures. *Medical Times and Gazette,* Vol. *1,* pp 110-111.

L'autopsia rivelò una lesione nella parte controlaterale del cervello, "sulla superficie dell'emisfero"

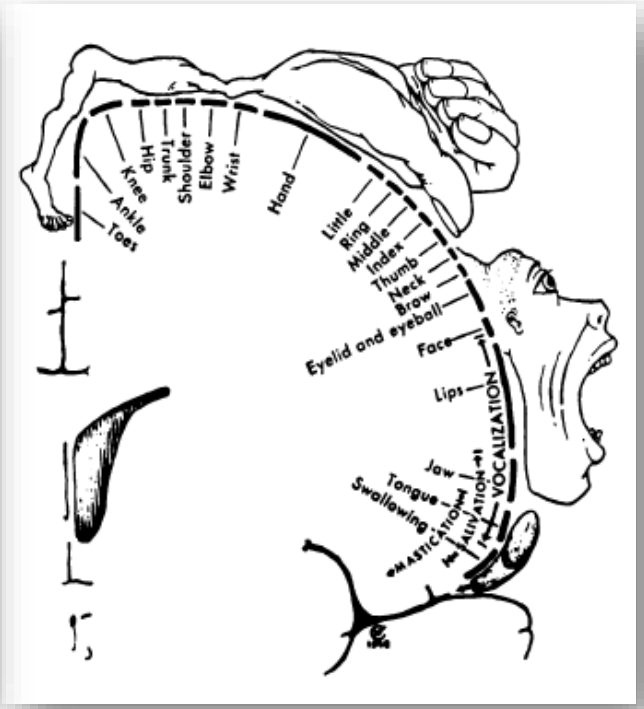
➔È la corteccia motoria a controllare i movimenti controlaterali del corpo e a causare le crisi epilettiche

1879: pubblicato uno dei primi casi di chirurgia dell'epilessia: il neurochirurgo scozzese MacEwen aveva resecato un meningioma frontale rendendo il paziente libero da crisi e senza deficit

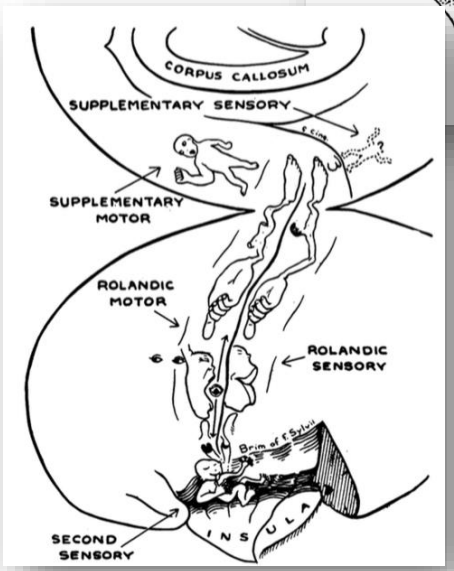
Penfield's homunculus

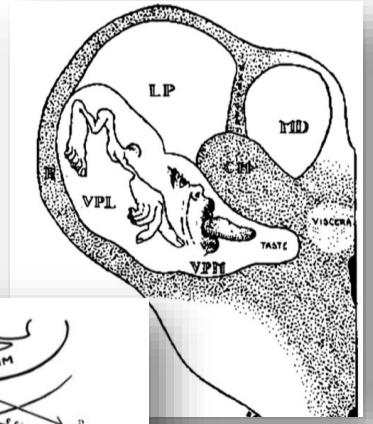


The first homunculus.
Penfield and Boldrey, 1937



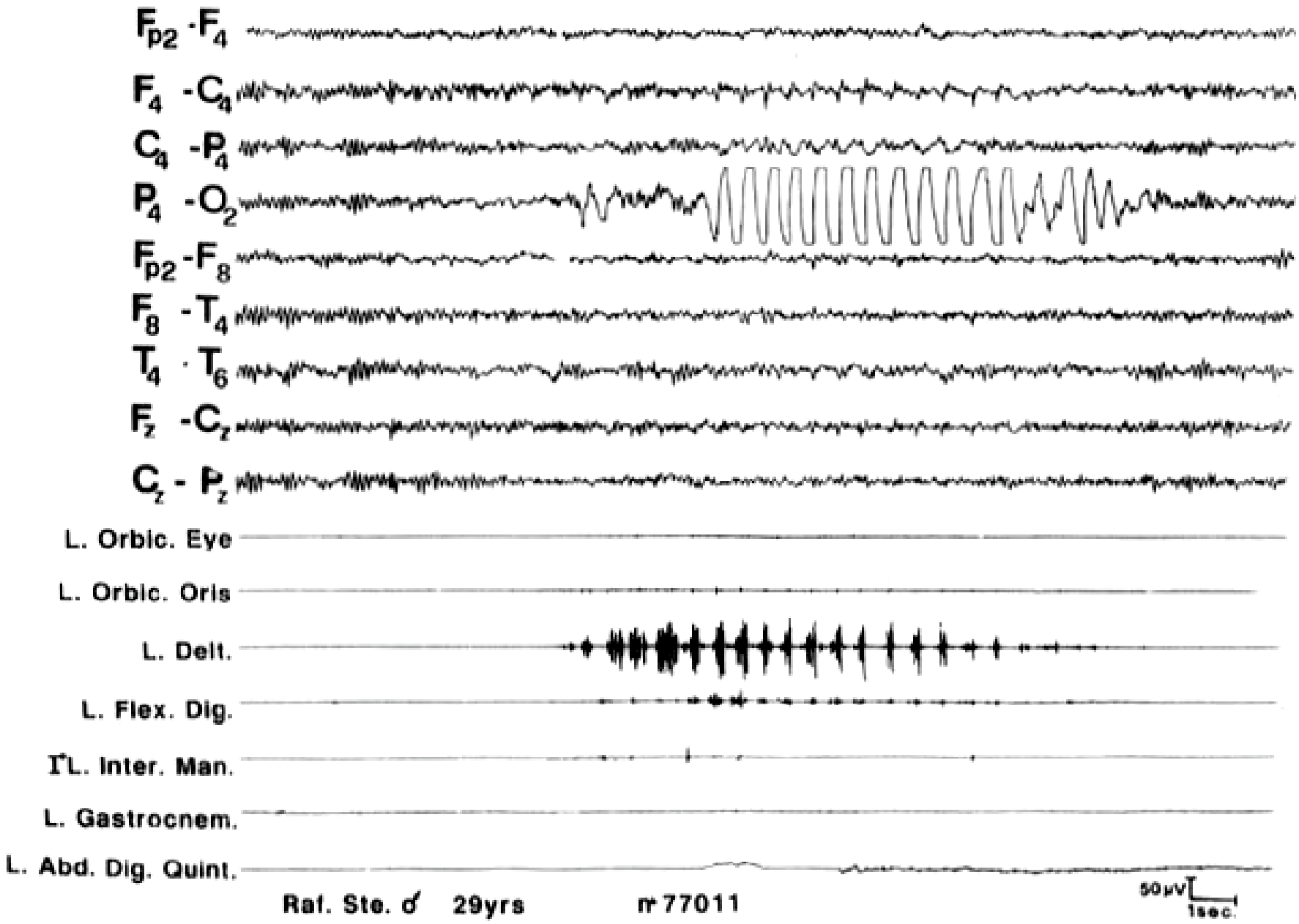
Motor homunculus.
Penfield and Rasmussen, 1950

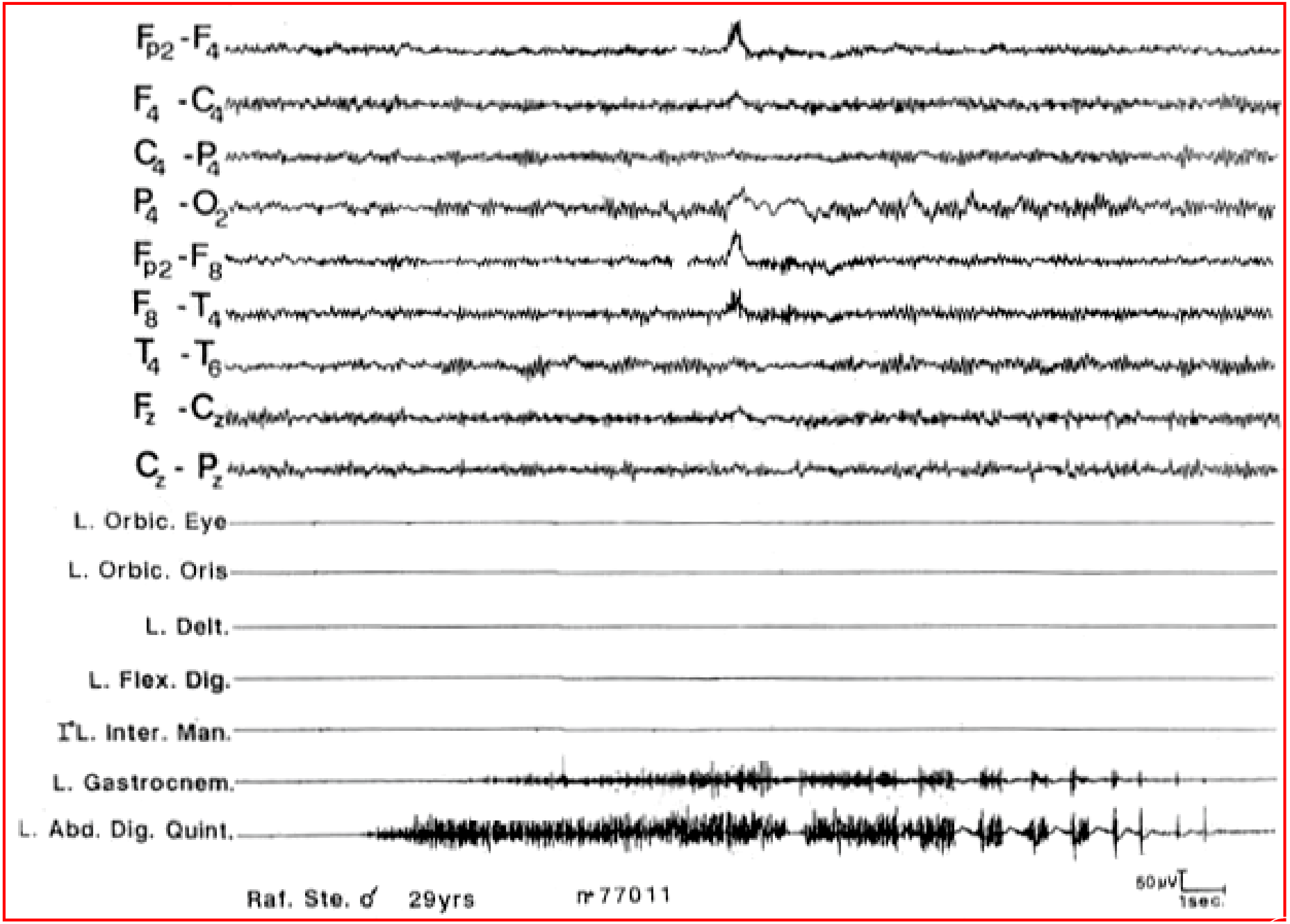




Penfield and Jasper,1954

t


F_{p2} - F_4
F_4 - C_4
C_4 - P_4
P_4 - O_2
F_{p2} - F_8
F_8 - T_4
T_4 - T_6
F_z - C_z
C_z - P_z
L. Orbic. Eye
L. Orbic. Oris
L. Delt.
L. Flex. Dig.
L. Inter. Man.
L. Gastrocnem.
L. Abd. Dig. Quint.
Raf. Ste. ♂ 29yrs
nº 77011
50 µV
1sec.


F_{p2} - F_4
F_4 - C_4
C_4 - P_4
P_4 - O_2
F_{p2} - F_8
F_8 - T_4
T_4 - T_6
F_z - C_z
C_z - P_z
L. Orbic. Eye
L. Orbic. Oris
L. Delt.
L. Flex. Dig.
L. Inter. Man.
L. Gastrocnem.
L. Abd. Dig. Quint.
Raf. Ste. ♂ 29yrs
nº 77011
50 µV
1sec.

1961

FRONTAL EPILEPTOGENIC FOCI AND THEIR CLINICAL CORRELATIONS

L. FEGERSTEN, M.D.[1] AND A. ROGER, M.D.[2]

Laboratory of Neurophysiology[3], Hôpital la Timone, Marseille (France)

(Received for publication: December 21, 1959)

(Resubmitted June 5, 1961)

The medical literature in recent years has included many studies on focal epilepsy as well as temporal lobe epilepsy. Despite the fact that human frontal lobes are being injured daily in motor-car accidents, frontal lobe lesions producing epilepsy have received little attention. We have, therefore, undertaken this study on frontal epileptogenic foci.

TABLE II

Types of seizures experienced by the patients

	Maximum of discharge				Total
	Fp	Fs	Fm	Fi	
Unconscious adversive	2		1	1	4
Simple adversive	9			1	10
Somatic-motor	6	3	1		10
Aphasic arrest				1	1
Somatic-sensory	3				3
Rising epigastric aura	3				3
"Generalized" (non-focal) seizure	3	2			5
No epileptic seizure	3	3			6

J Neurosurg. 1971 Nov;35(5):554-63.

Circling and rotational automatisms in patients with frontotemporal cortical and subcortical lesions.

Schneider RC, Calhoun HD, Kooi KA.

Brain. 1976 Sep;99(3):447-58.

Automatisms during frontal lobe epileptic seizures.

Geier S, Bancaud J, Talairach J, Bonis A, Enjelvin M, Hossard-Bouchaud H.

Abstract

Three new cases of automatisms occurring during frontal lobe epileptic seizures are reported. If these cases are added to those already published and adequately described in the literature, a total of 12 cases is obtained. An attempt is made to elucidate the clinical

Neurology. 1977 Oct;27(10):951-8.

The seizures of frontal lobe epilepsy. A study of clinical manifestations.

Geier S, Bancaud J, Talairach J, Bonis A, Szikla G, Enjelvin M.

Abstract

We describe ictal clinical manifestations of frontal lobe epileptic seizures in 22 patients. After examination of all ictal clinical data, 14 catergories of signs and symptoms were established. The validity of the ictal clinical data used was confirmed on the basis of 99 frontal lobe seizures recorded by tele-electroencephalogram or tele-stereo-electroencephalogram. The main conclusion is that the frontal lobe appears to be partially connected with motor acitivity.

Ann Neurol. 1985 Oct;18(4):497-504.

Complex partial seizures of frontal lobe origin.

Williamson PD, Spencer DD, Spencer SS, Novelly RA, Mattson RH.

Abstract

Complex partial seizures of medial or orbital frontal origin were documented in 10 of 90 patients with intractable epilepsy who were studied with depth electrodes. The clinical features that, in part, served to distinguish these seizures from complex partial seizures originating elsewhere included brief, frequent attacks, complex motor automatisms with kicking and thrashing, sexual automatisms, vocalization, and frequent development of complex partial status epilepticus. The constellation of clinical characteristics was often bizarre, leading to the erroneous diagnosis of hysteria. Stereotyped attack patterns helped establish the diagnosis of epilepsy. Interictal and ictal scalp electroencephalograms were often not helpful and were sometimes misleading.

Complex partial seizures of frontal lobe origin

"..interictal and ictal scalp electroencephalograms are often not helpful and sometimes misleading."

Peter D. Williamson, MD, Dennis D. Spencer, MD, Susan S. Spencer, MD, Robert A. Novelly, PhD, and Richard H. Mattson, MD

Ann Neurol 18:497-504,1985

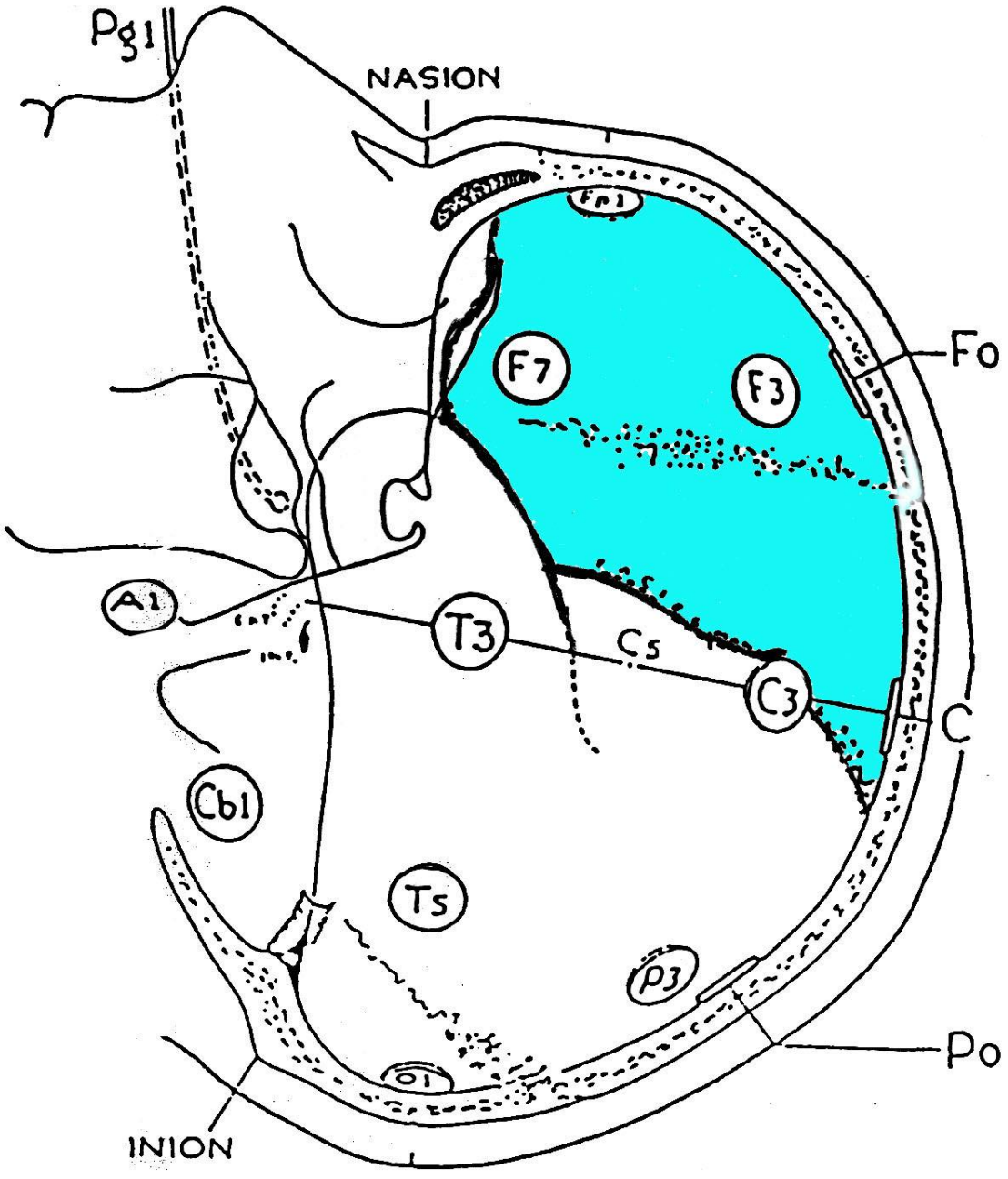
..the electrographic diagnosis of orbital seizures depends exclusively on the findings from chronically implanted electrodes

C. Ajmone - Marsan 1988

Le epilessie del lobo frontale. EEG intercritico e critico

Problemi:

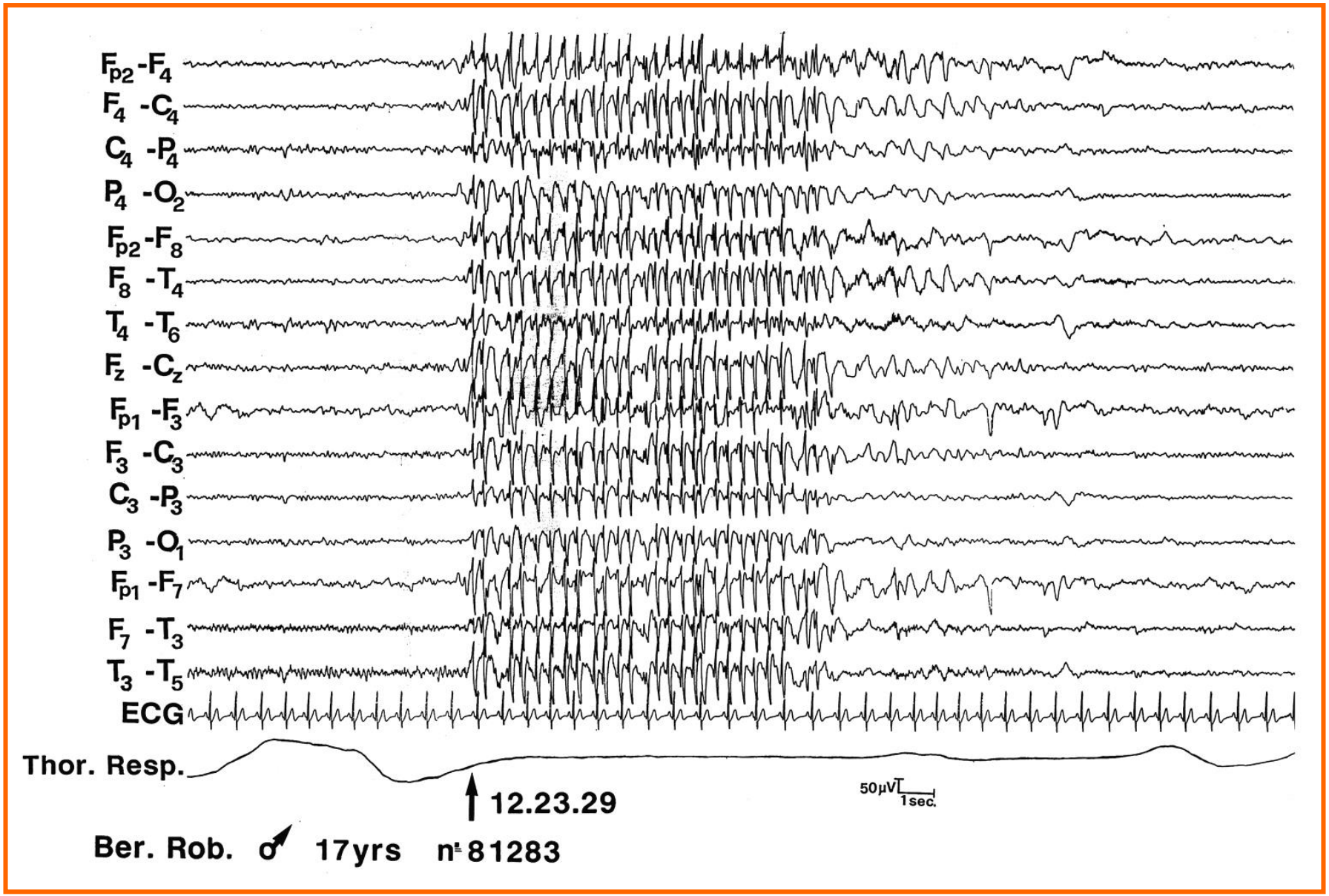
- ✓ Estensione dei lobi frontali e «faccie nascoste». (2/3 della superficie non accessibile a elettrodi EEG)
- ✓ Rapida diffusione alla convessità ipsi e contro-laterale
- ✓ Frequenti artefatti muscolari e da movimento

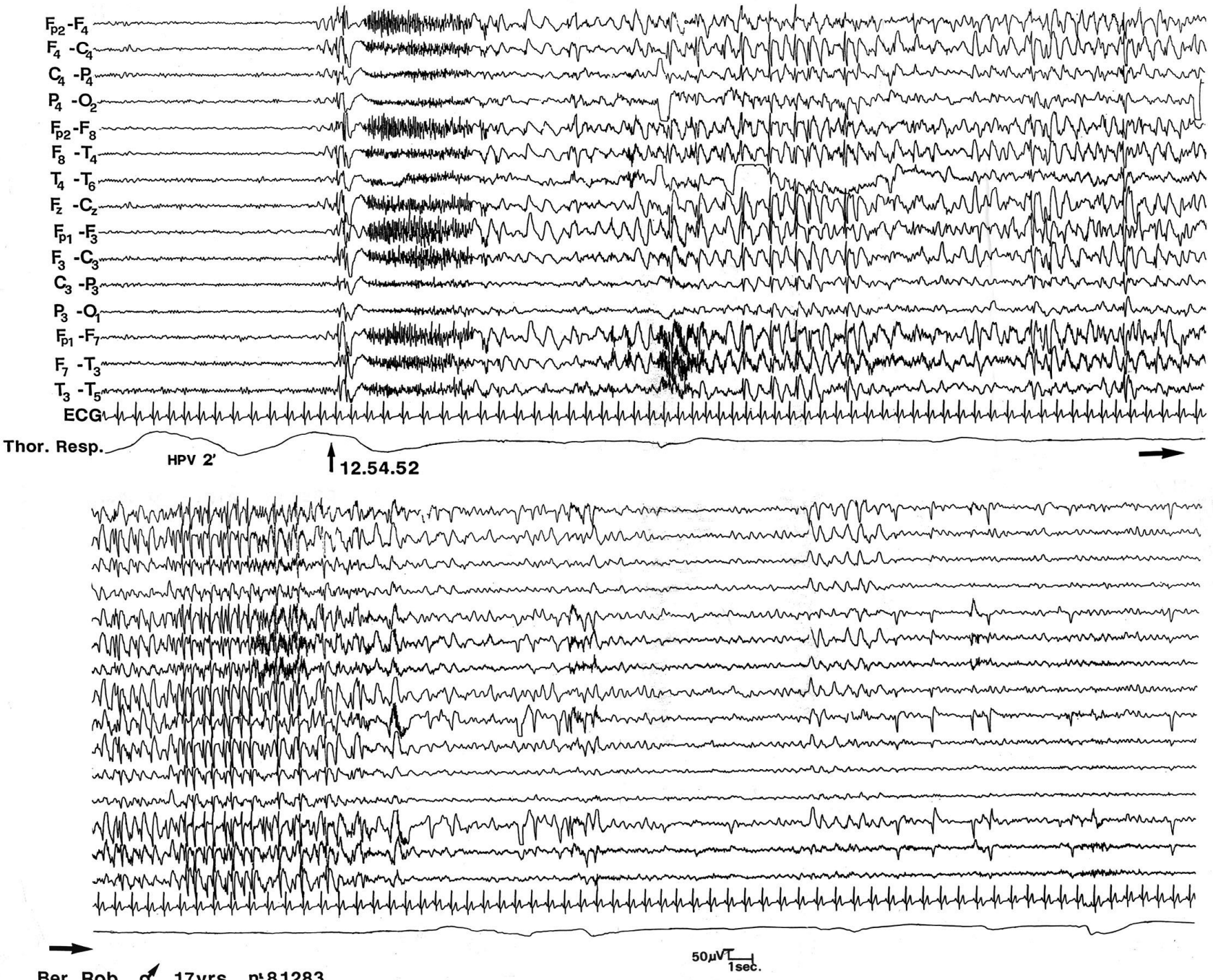

Pg1
NASION
Fp1
F7
F3
Fo
A1
T3
C5
C3
C
Cb1
T5
P3
O1
Po
INION

The Electroencephalogram in parasagittal lesions

K. Tukel and H Jasper. Electroenceph Clin Neurophysiol 1952 . 4:481-494

..these eegs may resemble closely those of petit mal . . .epilepsy”


Fp2-F4
F4 -C4
C4 -P4
P4 -O2
Fp2-F8
F8 -T4
T4 -T6
Fz -Cz
Fp1-F3
F3 -C3
C3 -P3
P3 -O1
Fp1-F7
F7 -T3
T3 -T5
ECG
Thor. Resp.
50µV
1sec.
12.23.29
Ber. Rob. ♂ 17yrs n° 81283


Fp2-F4
F4 -C4
C4 -P4
P4 -O2
Fp2-F8
F8 -T4
T4 -T6
Fz -Cz
Fp1 -F3
F3 -C3
C3 -P3
P3 -O1
Fp1 -F7
F7 -T3
T3 -T5
ECG
Thor. Resp.
HPV 2'
12.54.52
50µV
1sec.
Ber. Rob. ♂ 17yrs n° 81283

Clinical and EEG features of partial epilepsy with secondary bilateral synchrony

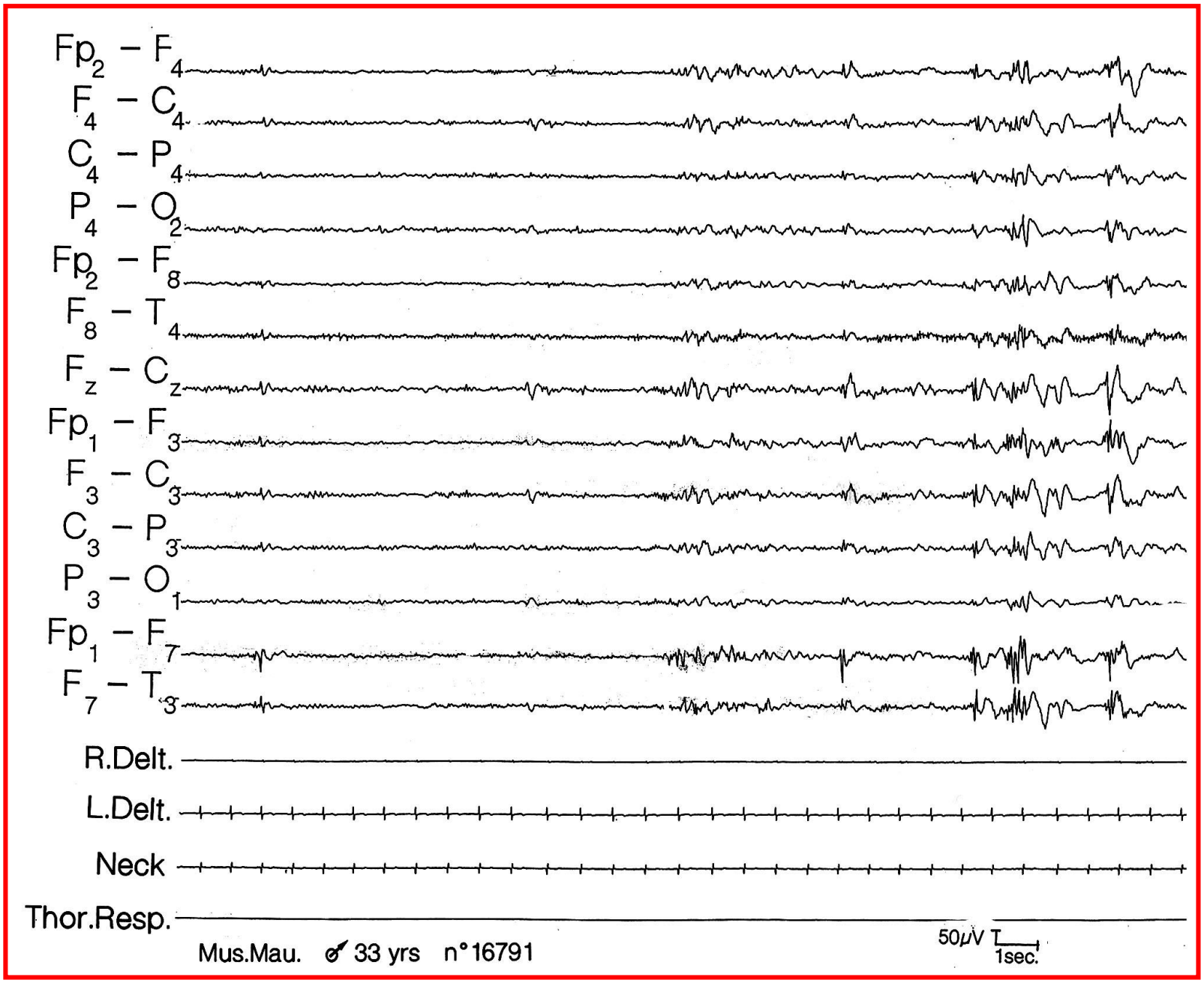
P. Tinuper, A. Cerullo, R. Riva, C. Marini, F. Provini, G. Plazzi, A. Baruzzi, E. Lugaresi. . *J. Epilepsy 1995;8:210-214*

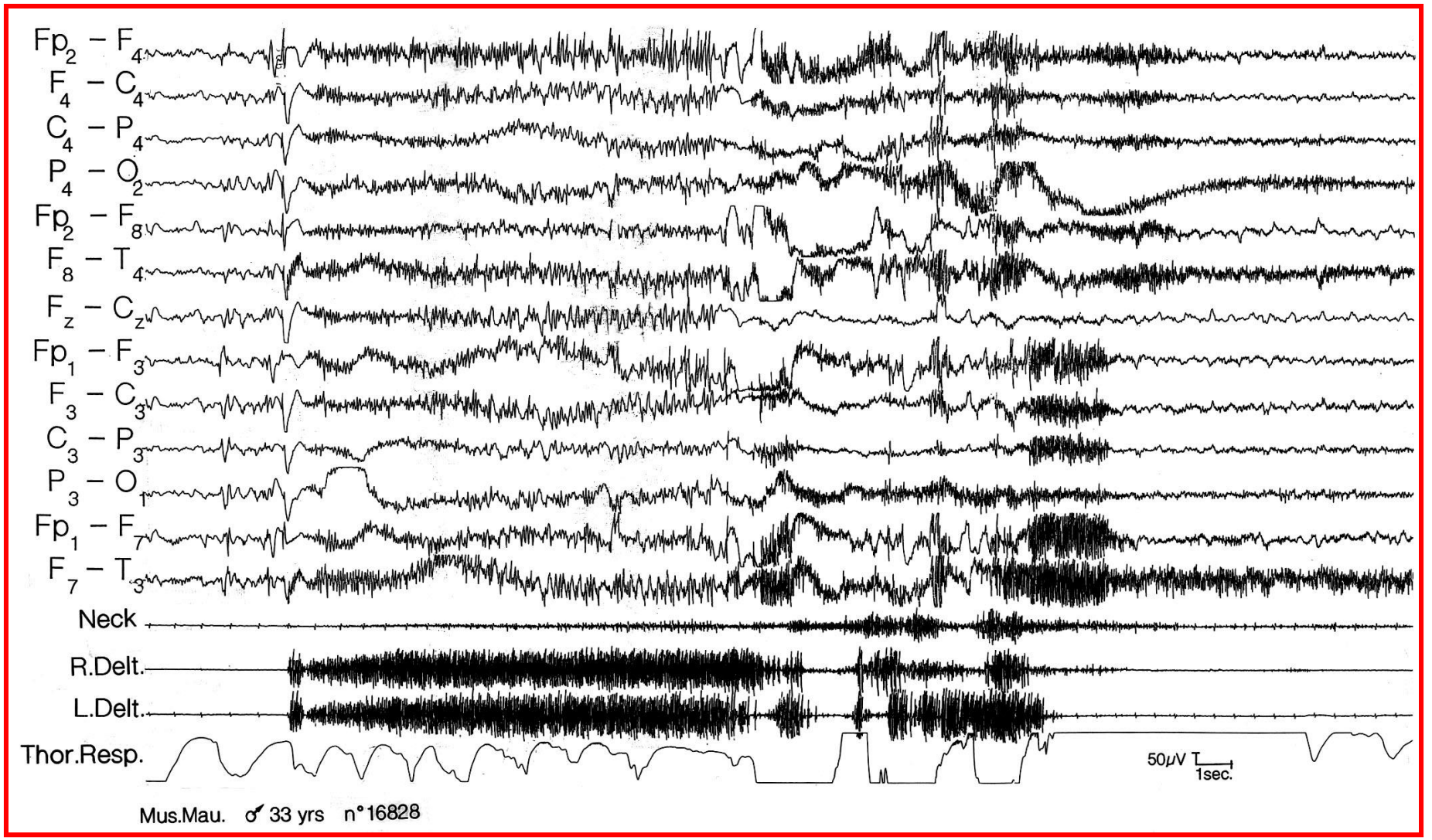
"…..SBS is an index of a severe outcome in PE "

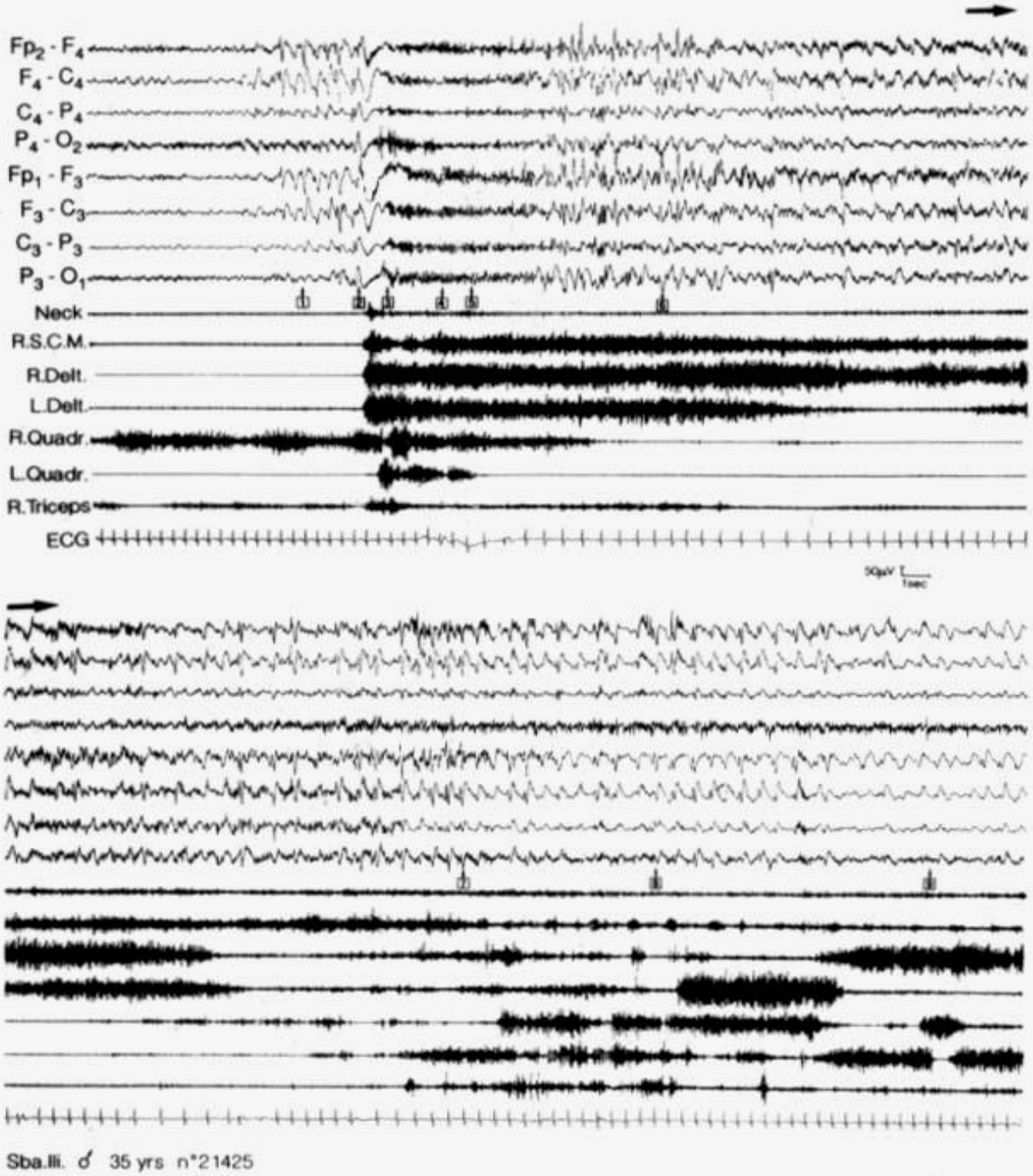
Epileptic drop attacks in partial epilepsy: clinical features, evolution, and prognosis

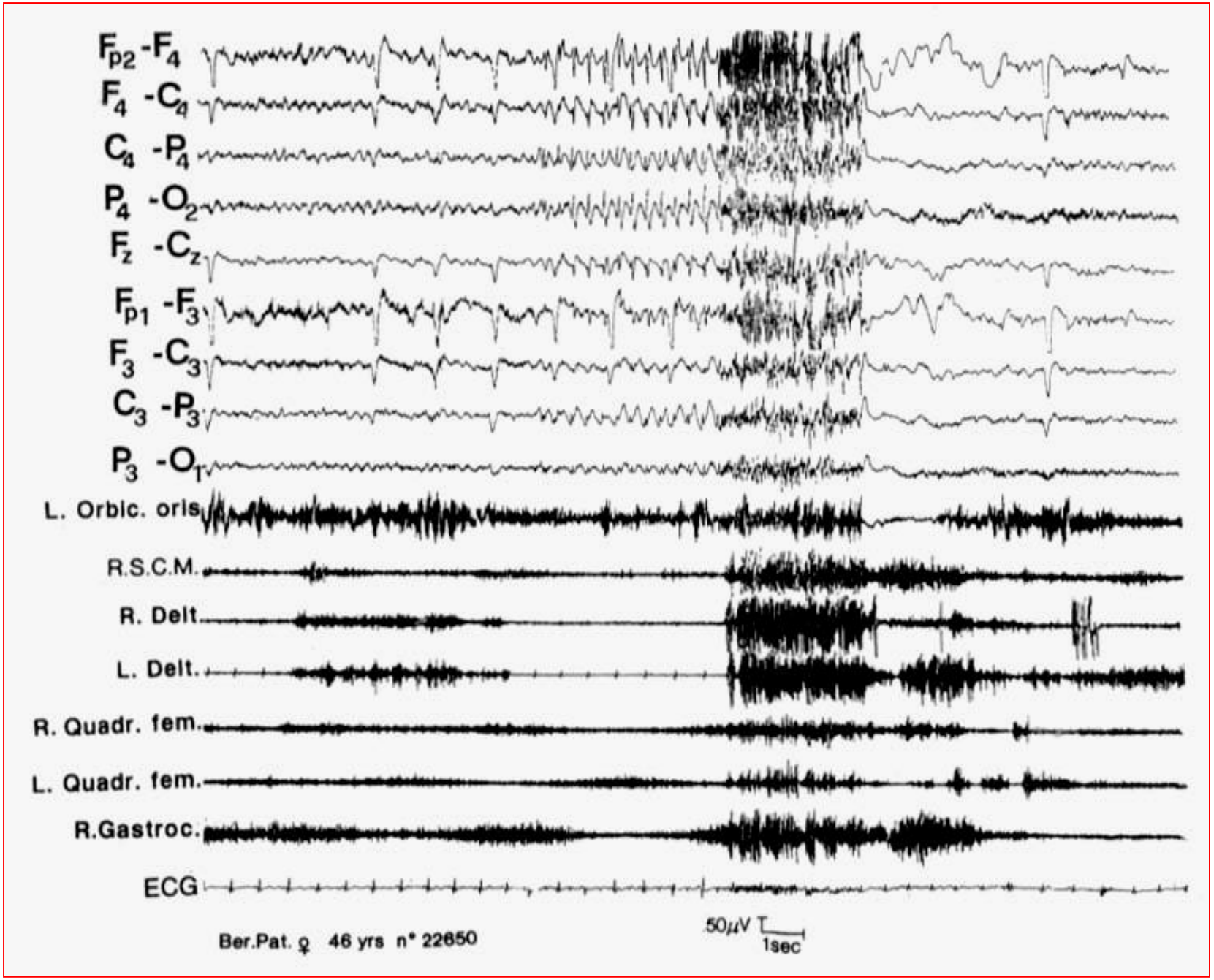
P. Tinuper, A. Cerullo, C. Marini, P. Avoni, A. Rosati, R. Riva, A. Baruzzi, E. Lugaresi. *J Neurol Neurosurg Psychiatry,1998;64:231-237*

"…..the physiopathogenetic substrate of epileptic drop attacks is a mechanism of secondary bilateral synchrony "


Fp2 – F4
F4 – C4
C4 – P4
P4 – O2
Fp2 – F8
F8 – T4
Fz – Cz
Fp1 – F3
F3 – C3
C3 – P3
P3 – O1
Fp1 – F7
F7 – T3
R.Delt.
L.Delt.
Neck
Thor.Resp.
Mus.Mau. ♂ 33 yrs n°16791
50µV
1sec.


Fp2 – F4
F4 – C4
C4 – P4
P4 – O2
Fp2 – F8
F8 – T4
Fz – Cz
Fp1 – F3
F3 – C3
C3 – P3
P3 – O1
Fp1 – F7
F7 – T3
Neck
R.Delt.
L.Delt.
Thor.Resp.
50μV
1sec.
Mus.Mau. ♂ 33 yrs n°16828


Fp2 - F4
F4 - C4
C4 - P4
P4 - O2
Fp1 - F3
F3 - C3
C3 - P3
P3 - O1
Neck
R.S.C.M.
R.Delt.
L.Delt.
R.Quadr.
L.Quadr.
R.Triceps
ECG
50µV
1sec
Sba.Ili. ♂ 35 yrs n°21425


Fp2-F4
F4 -C4
C4 -P4
P4 -O2
Fz -Cz
Fp1 -F3
F3 -C3
C3 -P3
P3 -O1
L. Orbic. oris
R.S.C.M.
R. Delt.
L. Delt.
R. Quadr. fem.
L. Quadr. fem.
R.Gastroc.
ECG
Ber.Pat. ♀ 46 yrs n° 22650
50μV
1sec

1972

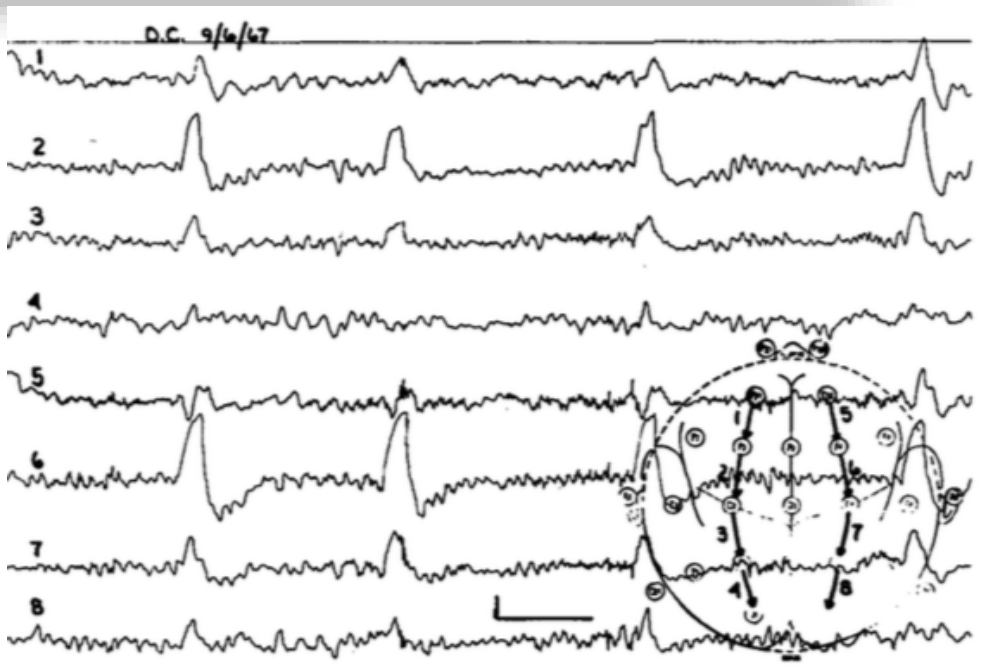
Orbital Frontal Seizures. An Unique Electroencephalographic and Clinical Syndrome*

BARRY R. THARP.

Stanford University Medical Center, Standford (Calif.)

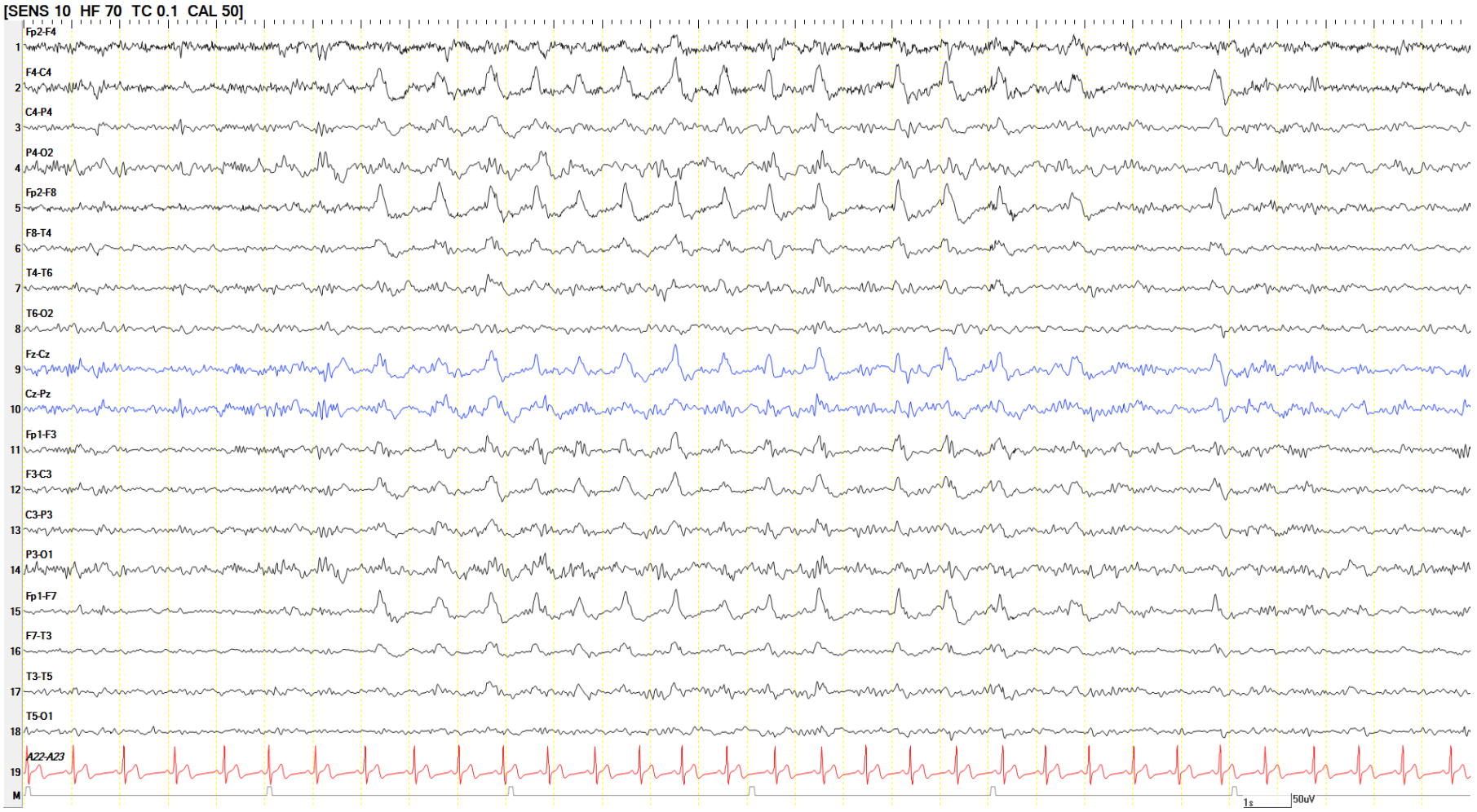
(Received April 21, 1972)

- three children with seizures characterized by bizarre motor attacks recurring during wakefulness
- One of them became seizure free after the surgical resection of a part of the frontal lobe (the orbital region)



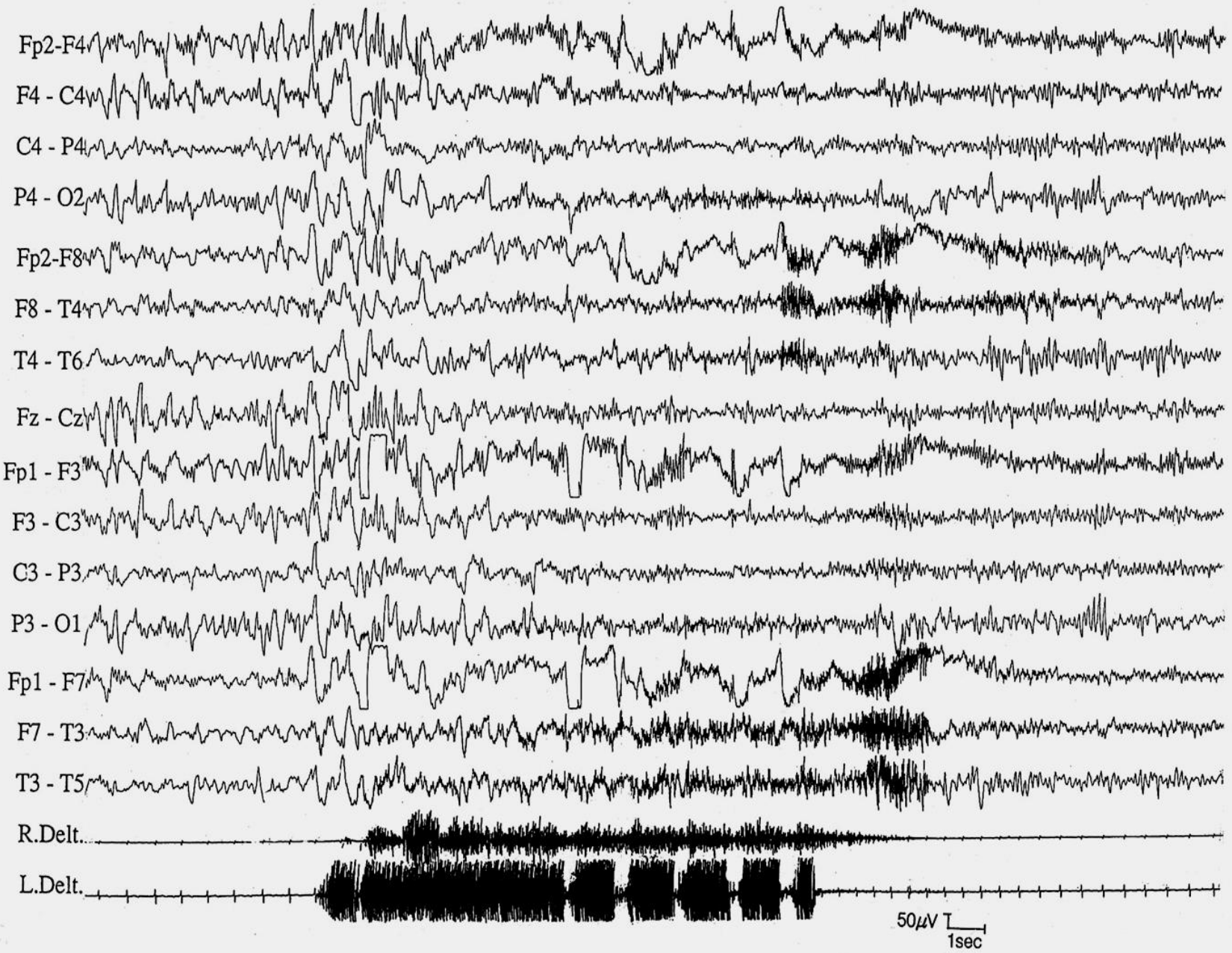
High-amplitude periodic mono- and diphasic sharp slow-waves present over the frontal regions bilaterally with the patient drowsy.

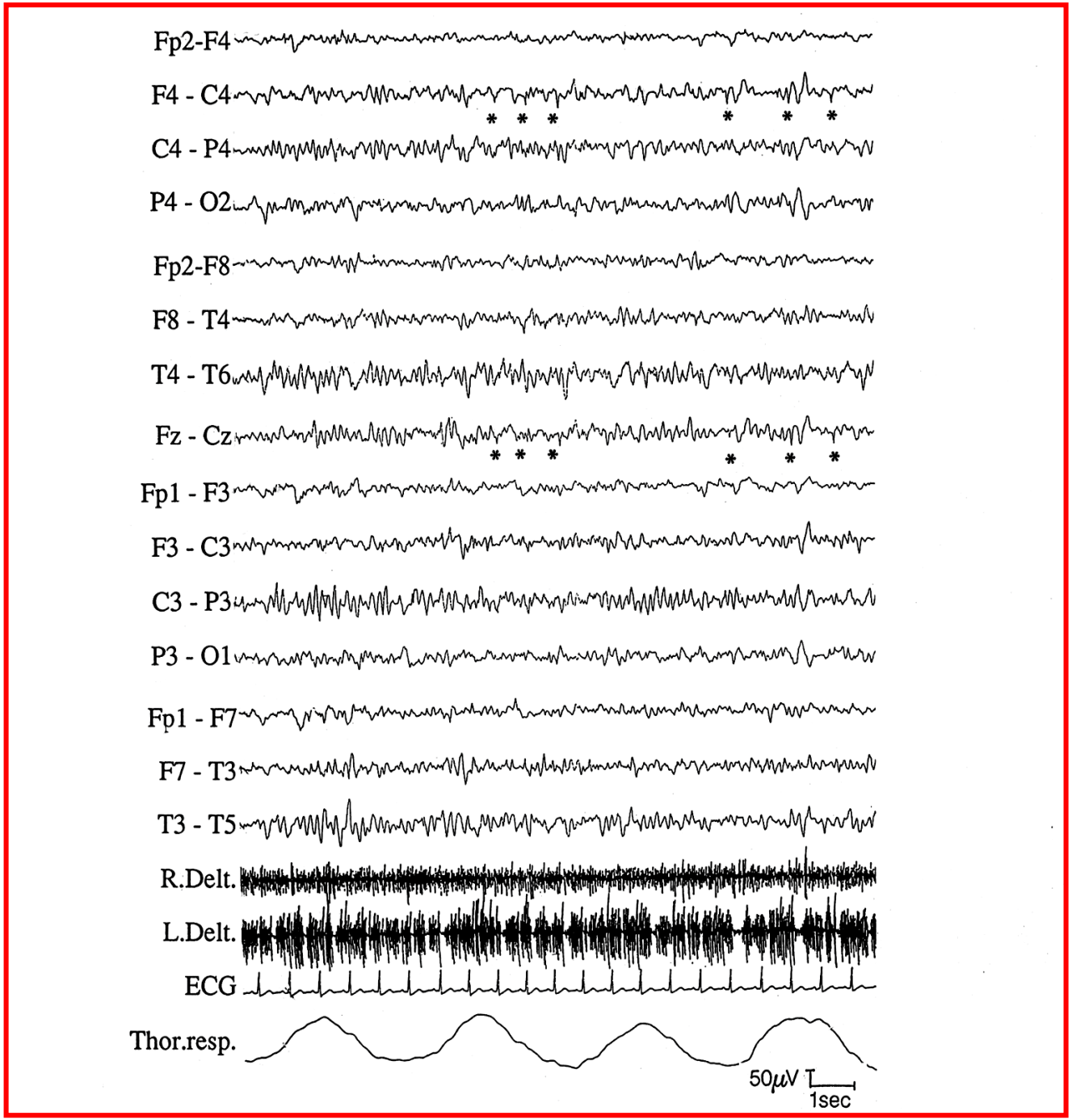
De Ru Pi

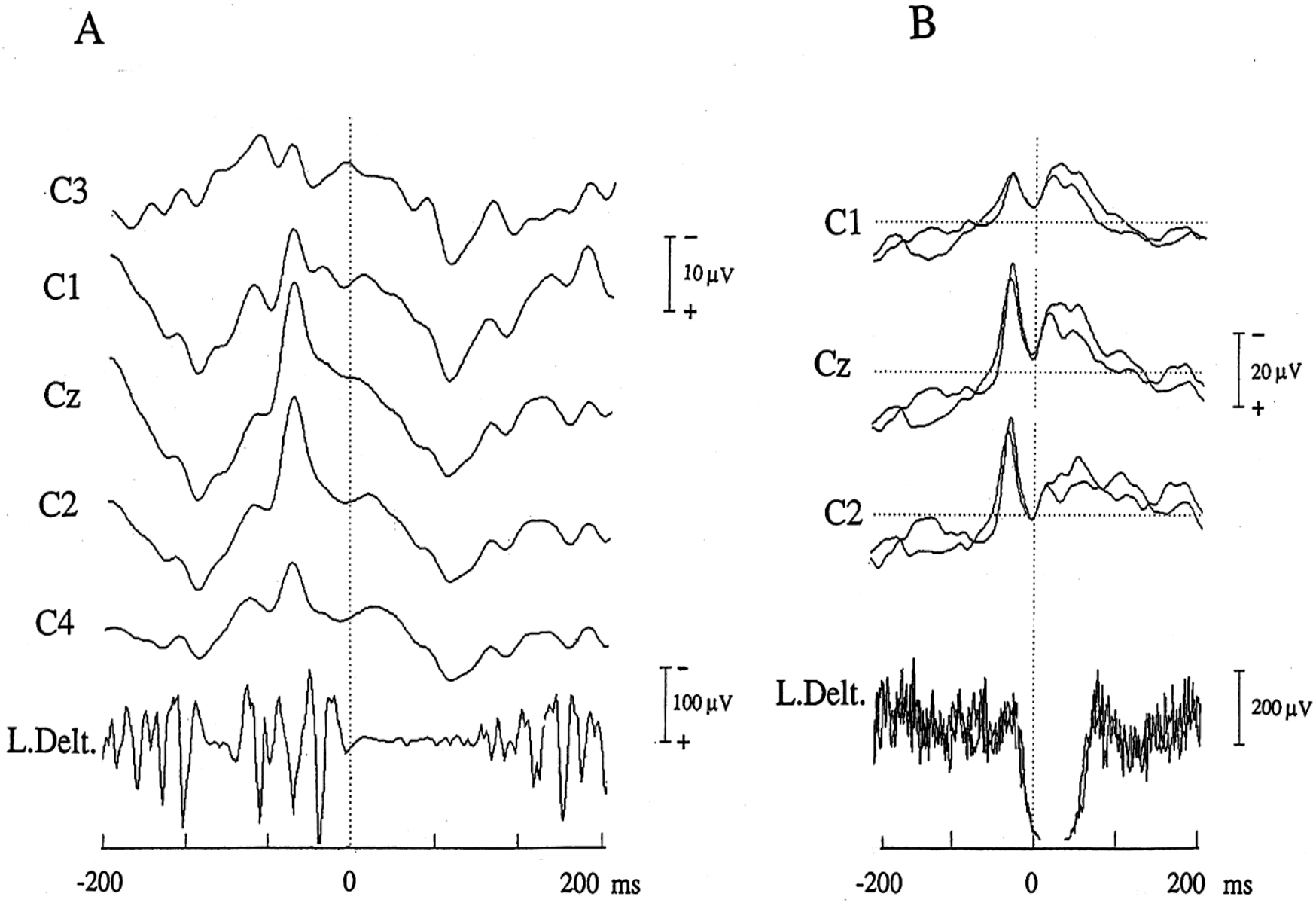

[SENS 10 HF 70 TC 0.1 CAL 50]
Fp2-F4
F4-C4
C4-P4
P4-O2
Fp2-F8
F8-T4
T4-T6
T6-O2
Fz-Cz
Cz-Pz
Fp1-F3
F3-C3
C3-P3
P3-O1
Fp1-F7
F7-T3
T3-T5
T5-O1
A22-A23
1s
50uV

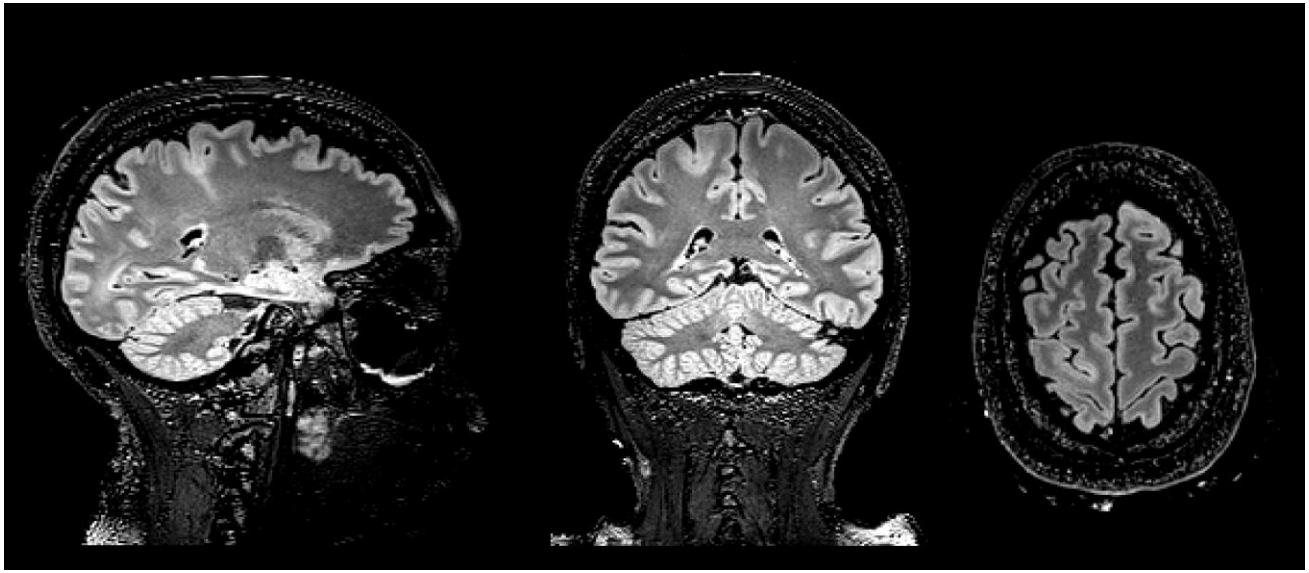
Scalp EEG nelle crisi del lobo frontale

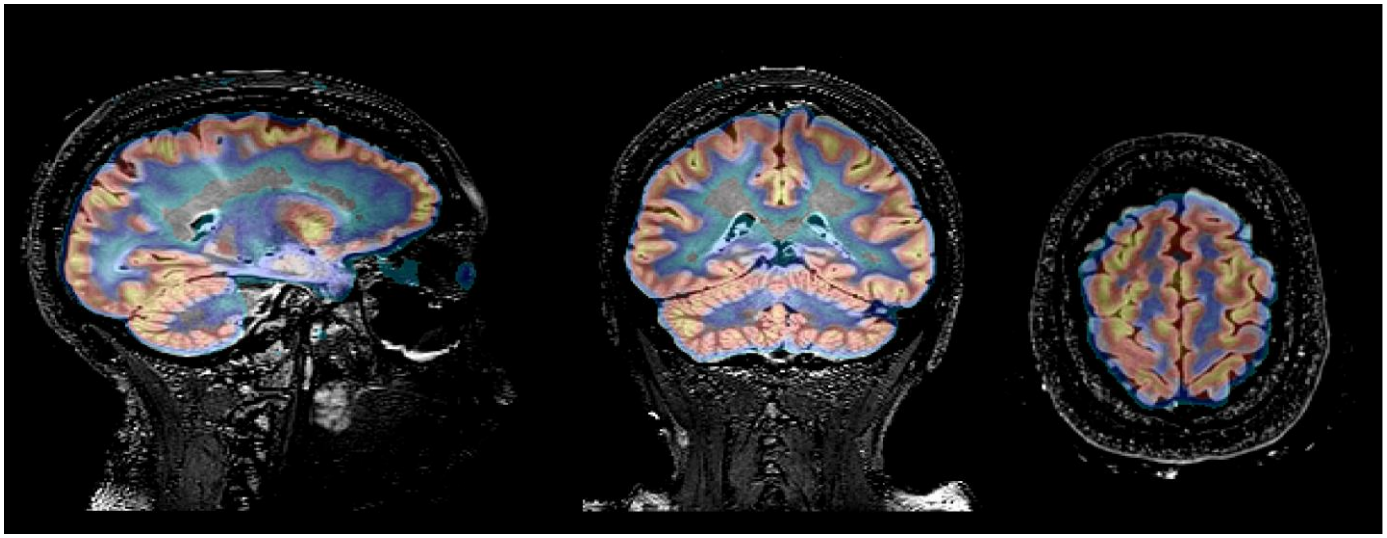
- ✓ Le scariche intercritiche e anche critiche possono essere difficili da identificare
- ✓ I parametri poligrafici possono essere molto utili nel correlare segni clinici con modificazioni EEG
- ✓ Lo studio Video-EEG è essenziale per la descrizione degli eventi critici


Fp2-F4
F4 - C4
C4 - P4
P4 - O2
Fp2-F8
F8 - T4
T4 - T6
Fz - Cz
Fp1 - F3
F3 - C3
C3 - P3
P3 - O1
Fp1 - F7
F7 - T3
T3 - T5
R.Delt.
L.Delt.
50μV
1sec


Fp2-F4
F4 - C4
C4 - P4
P4 - O2
Fp2-F8
F8 - T4
T4 - T6
Fz - Cz
Fp1 - F3
F3 - C3
C3 - P3
P3 - O1
Fp1 - F7
F7 - T3
T3 - T5
R.Delt.
L.Delt.
ECG
Thor.resp.
50μV
1sec


A
C3
C1
Cz
C2
C4
L.Delt.
10 µV
100 µV
-200
0
200 ms
B
C1
Cz
C2
L.Delt.
20 µV
200 µV
-200
0
200 ms





A livello della profondità del giro precentrale di destra la corteccia appare lievemente ispessita, si associa stria di iperintensità di segnale nelle sequenze pesate in T2, che si prolunga nel contesto della sottostante sostanza bianca ventricolo omolaterale ("transmantle sign").

Frontal lobe seizures: electroclinical features

- typically brief
- often manifest complex motor behavior, sometimes with emotional signs
- may be difficult to accurately observe and describe, in contrast to the relatively well-recognized patterns of temporal lobe seizures (Manford et al., 1996; O'Brien et al., 2008)
- The connectivity of frontal lobe supramodal associative areas supports spread through distant cortico-cortical efferent pathways, typically resulting in rapid, widespread propagation of seizure discharges originating in frontal regions, thus helping to explain both semiologic complexity and difficulties in EEG analysis.
- in the frontal lobe, accurate delineation of seizure onset is challenging given the large surface of buried cortex and peculiarities of craniocerebral anatomy, the ventromedial prefrontal region in particular being far from EEG electrodes placed on the scalp or on the cortical convexity.

Such difficulties in electroclinical localization almost certainly contribute to poorer outcome in surgical treatment of frontal lobe epilepsy compared to other epilepsy types (Tellez-Zenteno et al., 2005).

PARASONNIE E NFLE: l'origine del problema

Sleep, 4(2):129–138

Elio Lugaresi and Fabio Cirignotta

Hypnogenic Paroxysmal Dystonia: Epileptic Seizure or a New Syndrome?

Journal of Neurology, Neurosurgery, and Psychiatry 1986;**49**:375–380

Nocturnal paroxysmal dystonia

E LUGARESI, F CIRIGNOTTA, P MONTAGNA

From the Institute of Neurology, University of Bologna, Italy

NPD represents a syndrome of sleep related motor attacks……..Its precise nosological definition still awaits delucidations.

Oral and Bimanual-Bipedal Activity as Ictal Manifestations of Frontal Lobe Epilepsy. J. A. Wada and S. J. Purves (University of British Columbia, Vancouver, British Columbia, Canada).

Convulsive manifestations of frontal lobe epilepsy are reasonably well known, based primarily on the results of cortical stimulation studies which began over a century ago. In contrast, nonconvulsive manifestations have not been well defined and are the source of real concern when differentiating seizures of temporal or frontal lobe origin for potential surgical candidates.

We present 14 patients whose clinical episodes, often nocturnal, recur repetitively with short intervals, displaying screaming, yelling, coughing, whining, laboured breathing, and bimanual-bipedal activity, in addition to occasional versive movement, laughter, oral automatism, and genital manipulation, while retaining intact awareness, intermittent responsiveness, or becoming totally nonresponsive. Interictal epileptiform abnormality may be completely absent, or bifrontal slow waves, spikes and waves, or additional temporal lobe abnormality may be present. Ictal and postictal EEGs, often with poor demarcation between them, suggest frontal or frontotemporal localization. Three patients markedly benefited from anterior two-thirds callosal bisection, while temporal lobectomy in two patients was without effect. We conclude that nonconvulsive episodes with activity of mouth and both hands and legs as ictal manifestations with a tendency to nocturnal rapid repetition likely represent seizures of frontal lobe origin.

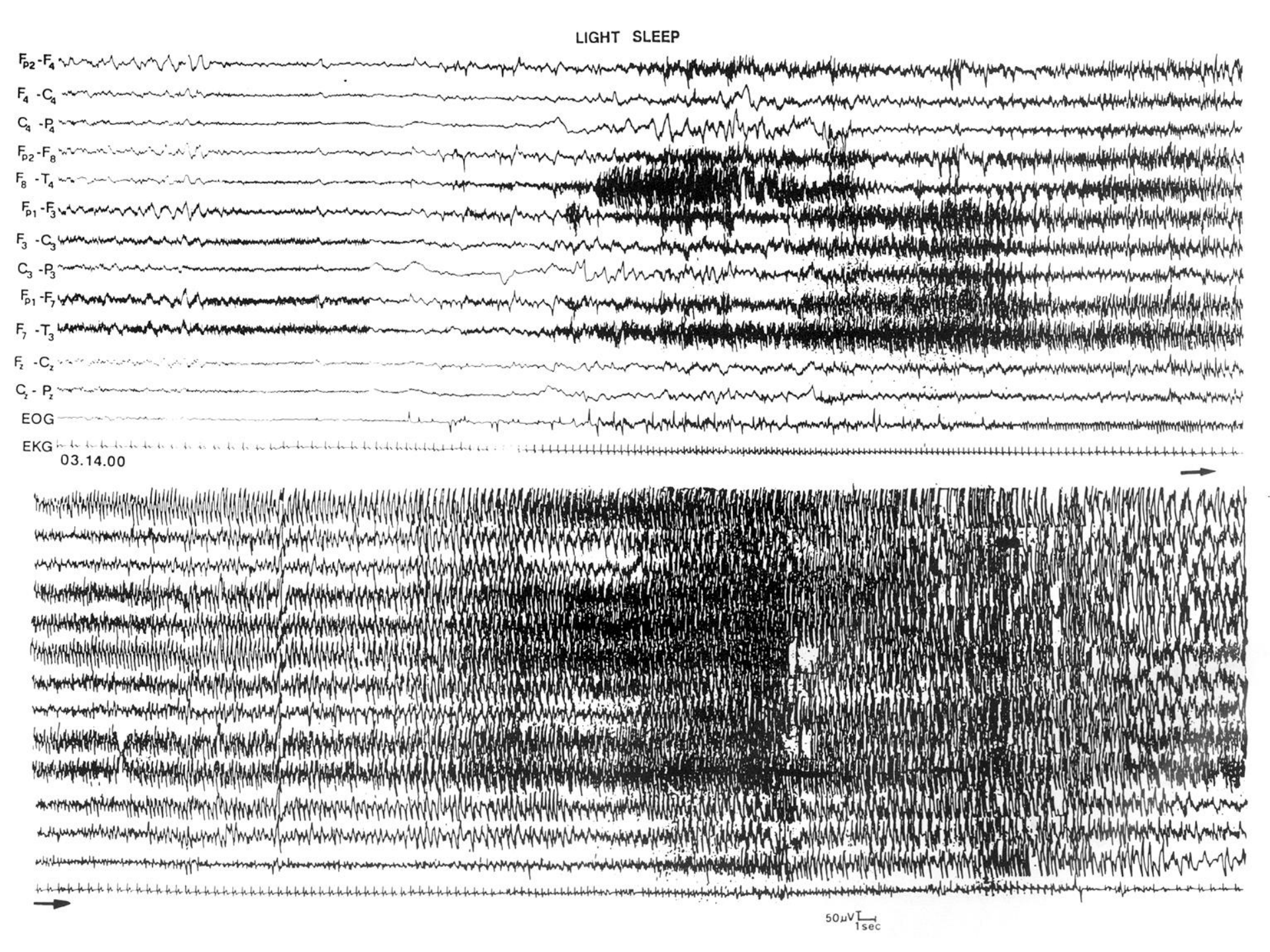
Epilepsia, Vol. 25, No. 5,1984

SOMETHING BECOME CLEAR...1990 -2009

Nocturnal Paroxysmal Dystonia with Short-Lasting Attacks: Three Cases with Evidence for an Epileptic Frontal Lobe Origin of Seizures

Paolo Tinuper, Angelina Cerullo, Fabio Cirignotta, Pietro Cortelli, Elio Lugaresi, and Pasquale Montagna

Epilepsia, **31**(5):549–556, 1990
Raven Press, Ltd., New York


LIGHT SLEEP
Fp2-F4
F4 -C4
C4 -P4
Fp2-F8
F8 -T4
Fp1-F3
F3 -C3
C3 -P3
Fp1-F7
F7 -T3
Fz -Cz
Cz - Pz
EOG
EKG
03.14.00
50μV
1sec

Nocturnal frontal lobe epilepsy
A clinical and polygraphic overview of 100 consecutive cases

F.Provini, G.Plazzi, P.Tinuper, S.Vandi, E.Lugaresi and P.Montagna (Brain 1999)

- N. 100 70% males
- Age at onset 1-64 yrs (mean 14 ±10)
- Personal history of parasomnia 34%
- At least one first degree with parasomnia 39%
- Family history of epilepsy 25% (30% NFLS)

- Seizures very frequent (during nonRem sleep 97%)
- Intraindividual stereotypy remarkable
- Ictal autonomic manifestations +++
- Neurological and neuropsychol. exam normal 86%
- Normal interictal EEG 55%
- Non epileptiform ictal EEG 45%
- CBZ inefficacy 32%

International Consensus Conference on Nocturnal Frontal Lobe Epilepsy

Bologna, 30th August – 1st September 2014

Aim

Update and clarify diagnostic criteria for NFLE

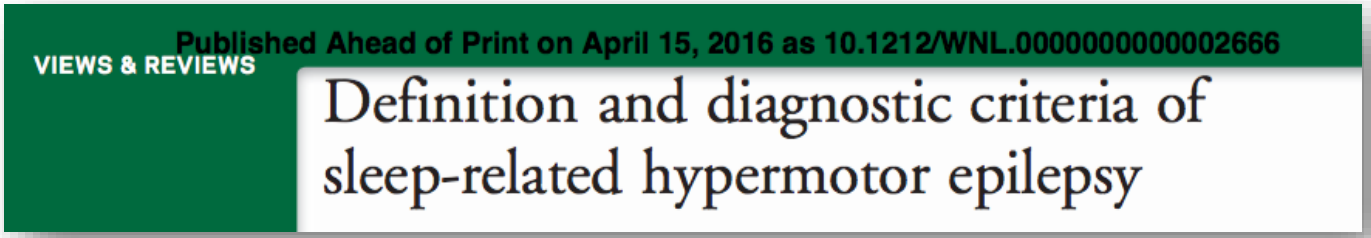
- Frequent difficulties in diagnosis
- Perception of under-diagnosis in many areas
- Disagreement on key features of the syndromes

Conference Methodology

Participants included experts in epilepsy, sleep, and epidemiology

Literature review completed before the Conference and working groups were assembled to address specific questions

SLEEP-RELATED HYPERMOTOR EPILEPSY (SHE)

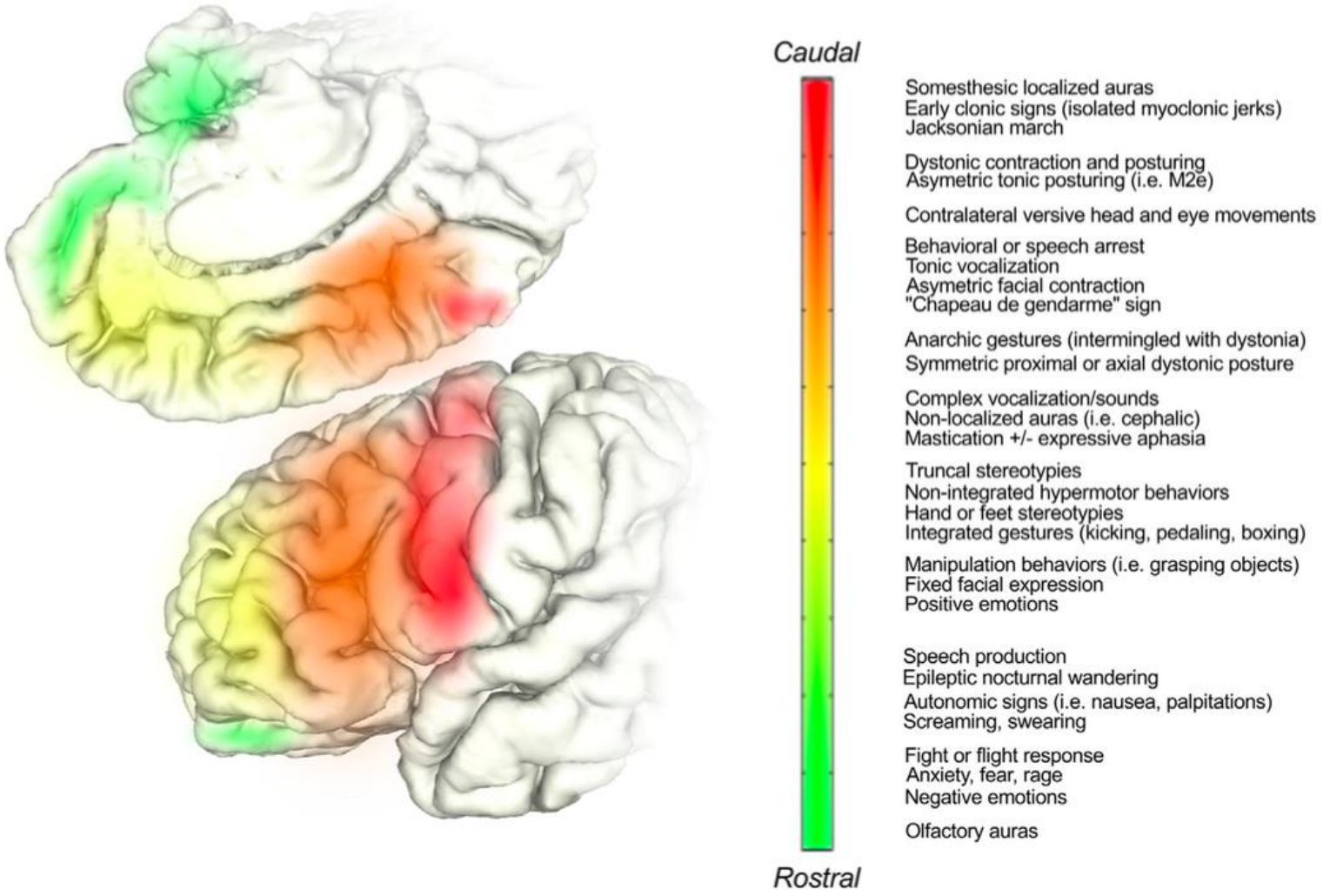


- ✓ Unique syndrome, independently of the aetiology (genetic, lesional or both) and the brain region involved (frontal or extra-frontal)
- ✓ "Hypermotor" seizures semiology: asymmetric tonic or dystonic posturing and/or hyperkinetic manifestations
- ✓ Seizures occur almost exclusively during sleep
- ✓ About one third of patients are drug-resistant
- ✓ Epilepsy surgery provides excellent results in selected SHE cases

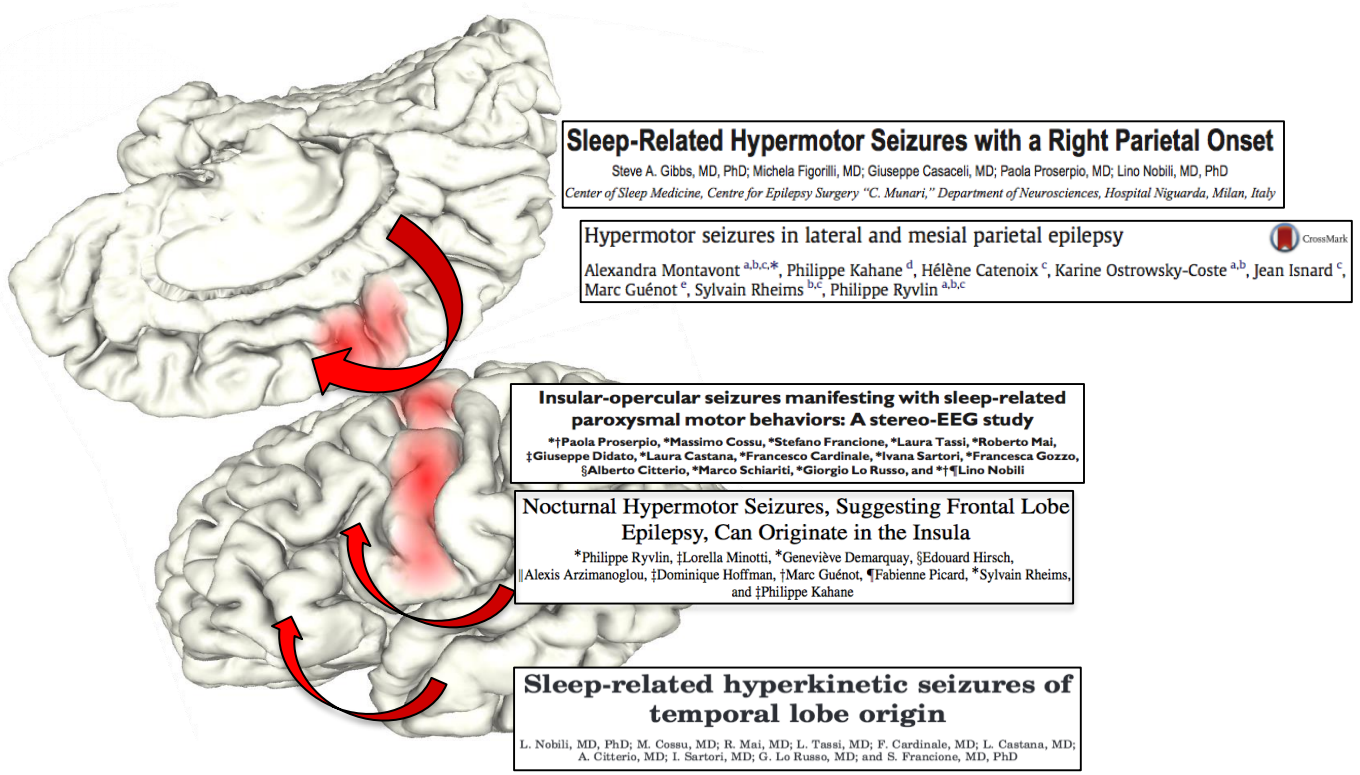
Tinuper *et al.*, 2016

Schematic representation of the rostrocaudal continuum of frontal lobe seizure manifestations derived from SEEG recordings

Gibbs *et al.*, 2016



Hypermotor seizures arising outside the frontal lobe



Sleep-Related Hypermotor Seizures with a Right Parietal Onset

Steve A. Gibbs, MD, PhD; Michela Figorilli, MD; Giuseppe Casaceli, MD; Paola Proserpio, MD; Lino Nobili, MD, PhD

Center of Sleep Medicine, Centre for Epilepsy Surgery "C. Munari," Department of Neurosciences, Hospital Niguarda, Milan, Italy

Hypermotor seizures in lateral and mesial parietal epilepsy

Alexandra Montavont [a,b,c,*], Philippe Kahane [d], Hélène Catenoix [c], Karine Ostrowsky-Coste [a,b], Jean Isnard [c], Marc Guénot [e], Sylvain Rheims [b,c], Philippe Ryvlin [a,b,c]

Insular-opercular seizures manifesting with sleep-related paroxysmal motor behaviors: A stereo-EEG study

*†Paola Proserpio, *Massimo Cossu, *Stefano Francione, *Laura Tassi, *Roberto Mai, ‡Giuseppe Didato, *Laura Castana, *Francesco Cardinale, *Ivana Sartori, *Francesca Gozzo, §Alberto Citterio, *Marco Schiariti, *Giorgio Lo Russo, and *†¶Lino Nobili

Nocturnal Hypermotor Seizures, Suggesting Frontal Lobe Epilepsy, Can Originate in the Insula

*Philippe Ryvlin, ‡Lorella Minotti, *Geneviève Demarquay, §Edouard Hirsch, ‖Alexis Arzimanoglou, ‡Dominique Hoffman, †Marc Guénot, ¶Fabienne Picard, *Sylvain Rheims, and ‡Philippe Kahane

Sleep-related hyperkinetic seizures of temporal lobe origin

L. Nobili, MD, PhD; M. Cossu, MD; R. Mai, MD; L. Tassi, MD; F. Cardinale, MD; L. Castana, MD; A. Citterio, MD; I. Sartori, MD; G. Lo Russo, MD; and S. Francione, MD, PhD

The delay between the SEEG ictal onset and the appearance of complex motor behaviors ranged from 5–40 s (mean 20 s) (Proserpio et al. 2011)

Courtesy of Gibbs and Nobili. Niguarda Hospital. Milano. Italy

Received: 3 February 2018 | Revised: 13 February 2019 | Accepted: 13 February 2019

DOI: 10.1111/epi.14690

FULL-LENGTH ORIGINAL RESEARCH

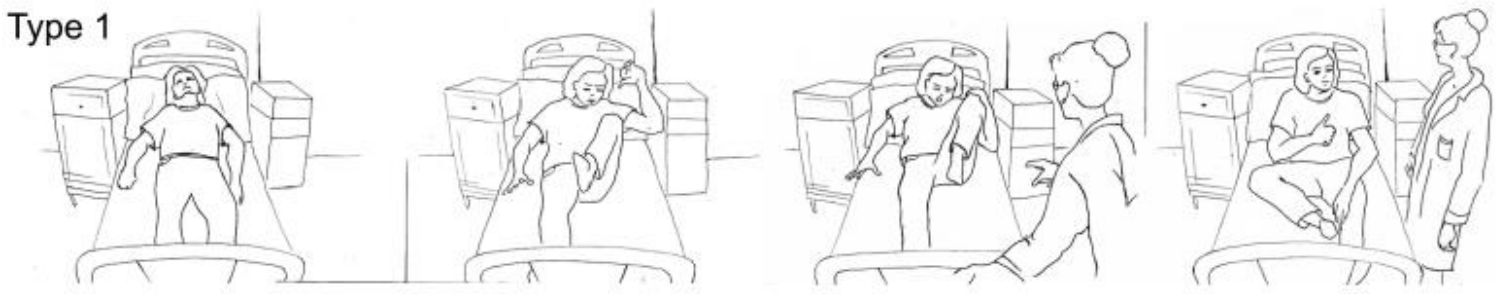
Epilepsia®

Clinical features of sleep-related hypermotor epilepsy in relation to the seizure-onset zone: A review of 135 surgically treated cases

Steve A. Gibbs[1,2] | Paola Proserpio[1] | Stefano Francione[1] | Roberto Mai[1] | Francesco Cardinale[1] | Ivana Sartori[1] | Laura Castana[1] | Giuseppe Plazzi[3,4] | Paolo Tinuper[3,4] | Massimo Cossu[1] | Giorgio Lo Russo[1] | Laura Tassi[1] | Lino Nobili[1,5]

TYPE I

early elementary motor signs, which included early clonic signs, asymmetric tonic postures and/or an asymmetric facial contraction.

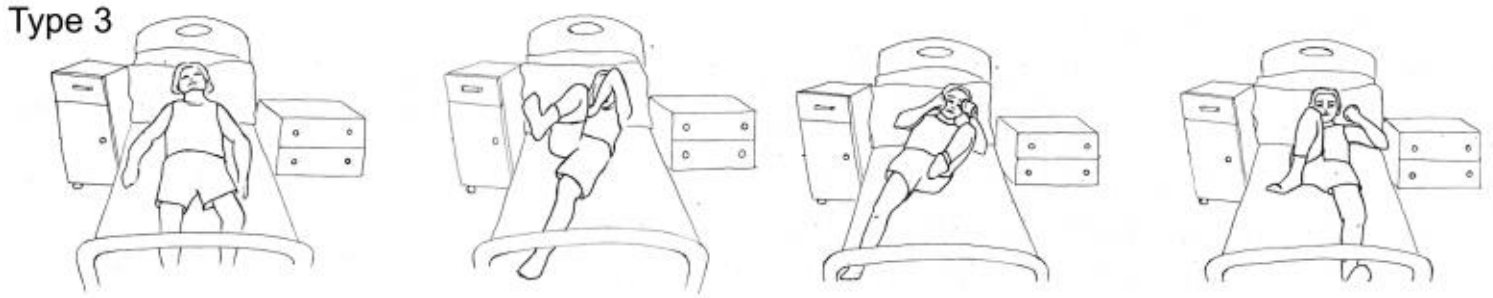


TYPE 2

unnatural hypermotor movements, which included non-integrated or anarchic gestural hypermotor movements with axial tonic postures and/or symmetric facial contractions.

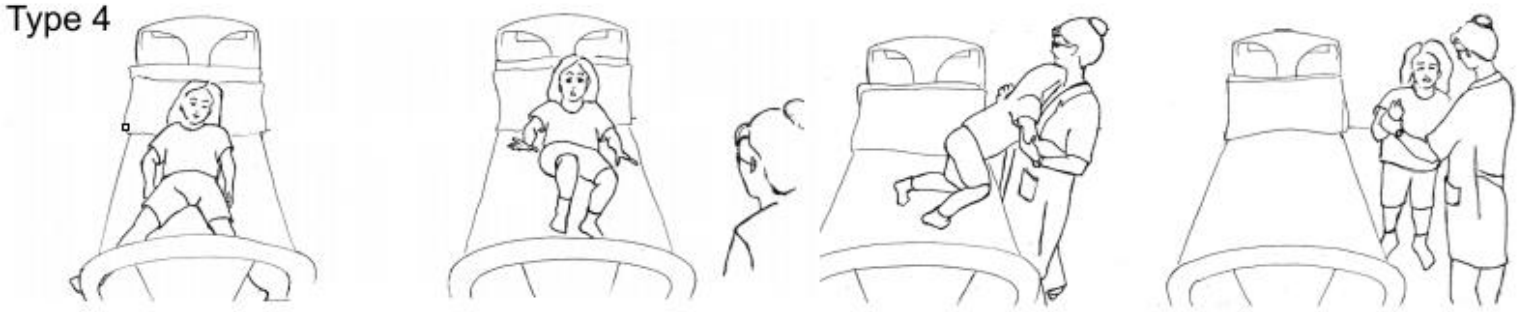
TYPE 3

integrated hypermotor movements, which included hyperkinetic behaviours (pedalling, kicking, rocking), distal stereotypies and/or manipulation/utilisation movements in the absence of clear a goal-directed purpose.



TYPE 4

gestural behaviours with high emotional content, which included integrated gestural behaviours of fear, fight or flight behaviour, frightened facial expression and/or autonomic signs.



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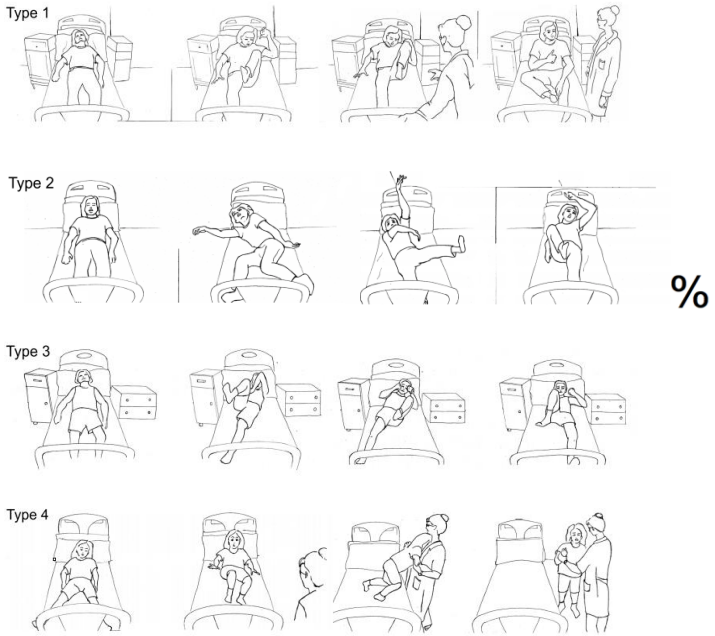
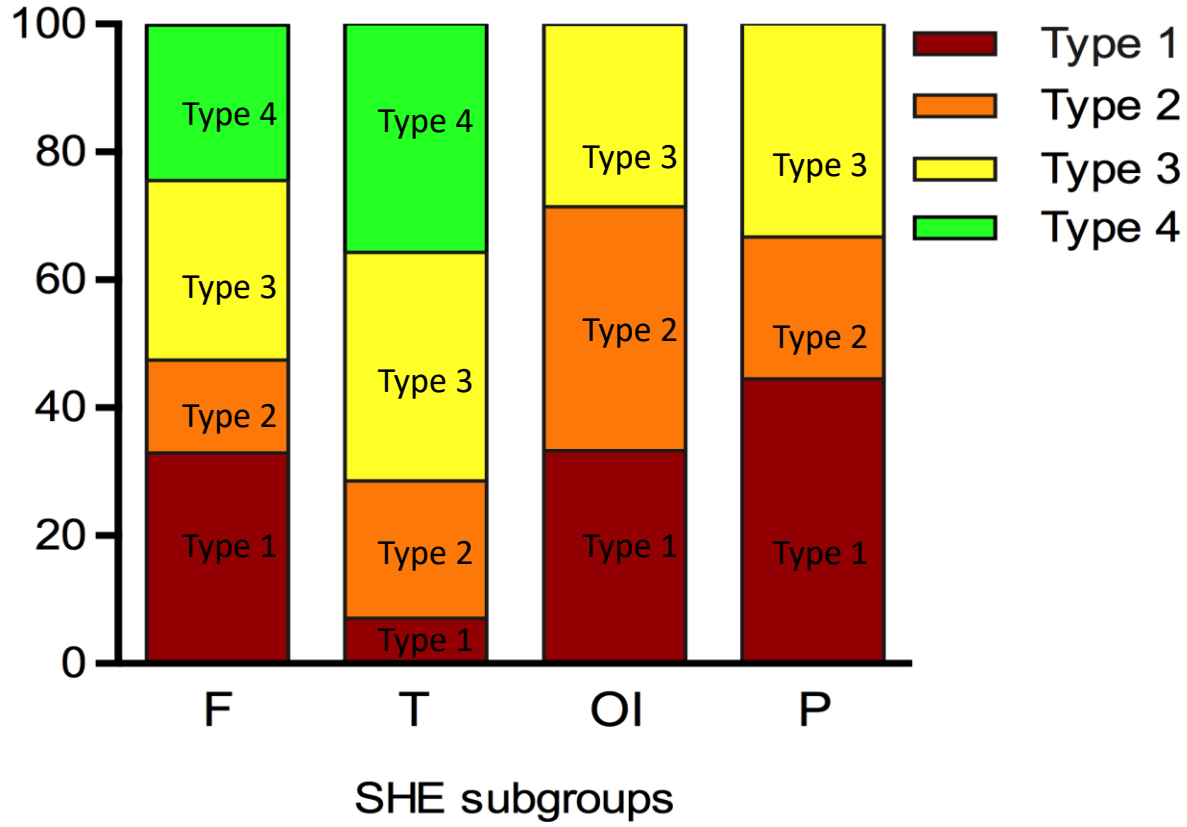
Extra-frontal SHE
Early seizure semiology





The Type 1 pattern (simple motor) was never present in temporal Sz; wherease Type 4 pattern (agitated behaviour, emotional content) was never present in posterior or insular Sz

doi:10.1093/brain/awy219 BRAIN 2018: 141; 3035–3051 | 3035

BRAIN
A JOURNAL OF NEUROLOGY

Motor and emotional behaviours elicited by electrical stimulation of the human cingulate cortex

Fausto Caruana,[1] Marzio Gerbella,[2] Pietro Avanzini,[3] Francesca Gozzo,[4] Veronica Pelliccia,[1,4] Roberto Mai,[4] Rouhollah O. Abdollahi,[1] Francesco Cardinale,[4] Ivana Sartori,[4] Giorgio Lo Russo[4] and Giacomo Rizzolatti[1,3]

See Apps (doi:10.1093/brain/awy224) for a scientific commentary on this article.

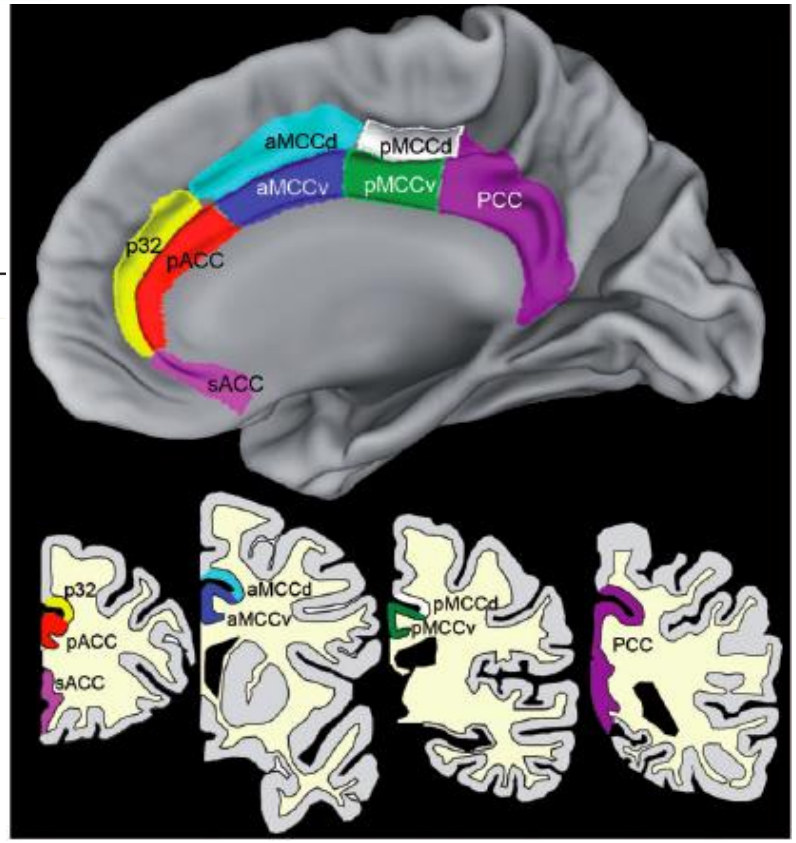


Figure 1 Anatomical boarders of the cingulate cortex. The *top* panel shows eight cingulate sectors in a mesial view of the fs_LR brain template, using Caret software. The *bottom* panel shows the same subdivision in four representative coronal sections. Anatomical boarders of the cingulate cortex were adapted from the following anatomical studies: the subgenual sector of ACC (sACC) includes area 25, s24 and s32 from Palomero-Gallagher *et al.* (2015). The pregenual ACC (pACC) and pregenual area 32 (p32) are from Palomero-Gallagher *et al.* (2008). The rostro-caudal subdivision of MCC in anterior and posterior sectors (aMCC and pMCC) was derived from Vogt *et al.* (2003), Vogt (2005) and Palomero-Gallagher *et al.* (2009). In addition, following Palomero Gallagher *et al.* (2009), both aMCC and pMCC were further subdivided in dorsal (aMCCd and pMCCd) and ventral (aMCCv and pMCCv) sectors, corresponding to their areas 24c'd and 24c'v. Finally, PCC was retrieved from Vogt *et al.* (2003) and Leech and Sharp (2014).

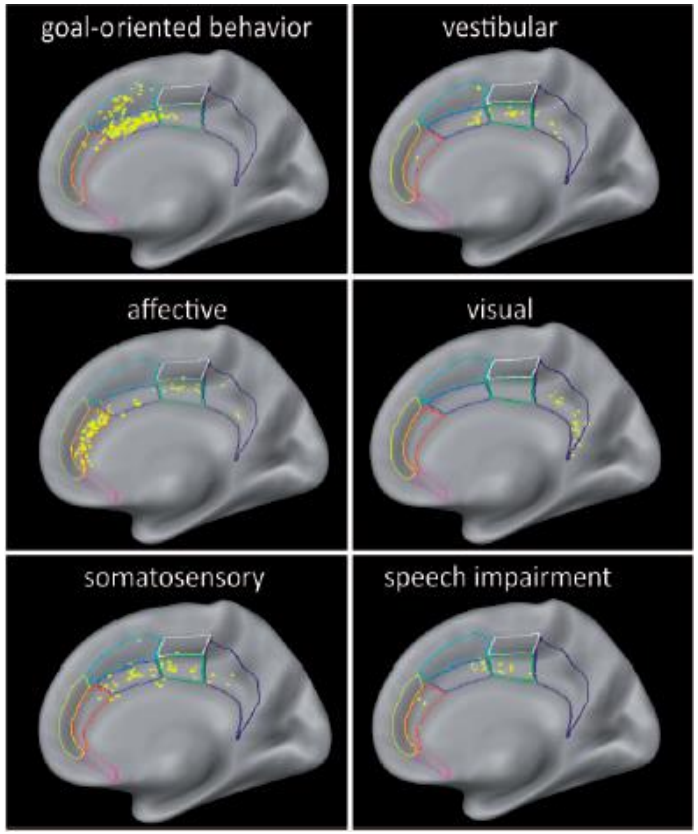
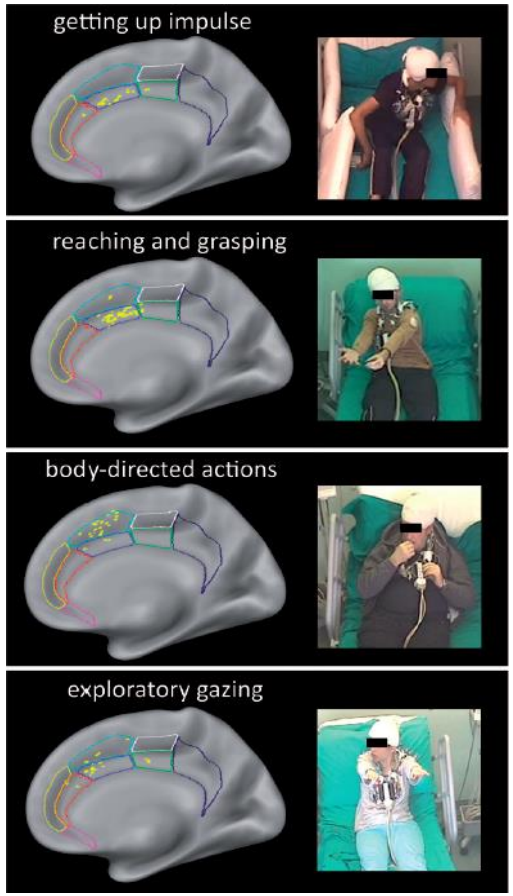
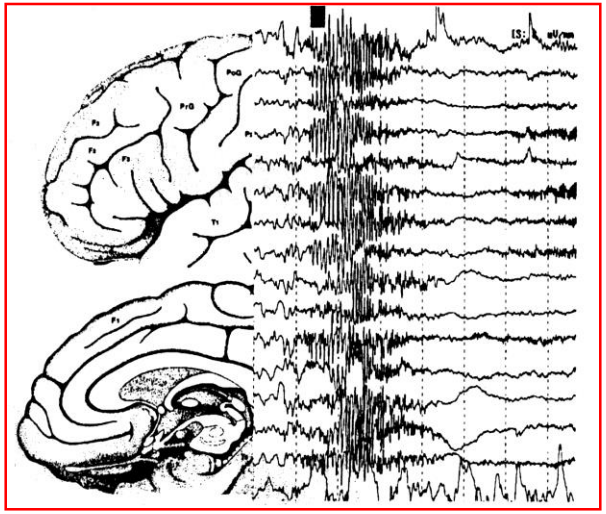


Figure 3 Anatomical distribution of behavioural and subjective responses. Anatomical distribution of the sites whose stimulation elicits behavioural and subjective responses belonging to the main six categories or response. Both left and right sites are plotted on the right hemisphere of the inflated surface of the fs_LR brain template.

Figure 5 Goal-oriented behavioural responses. Anatomical distribution of the four main subcategories of goal-oriented behavioural responses. For each of them, the *left* panel depicts the anatomical location of sites whose stimulation elicits goal-oriented behaviours. *Right*: For each subcategory a representative frame recovered from Supplementary Videos 1–4 is shown.





Claudio Munari Workshop 2003

Electro-clinical semiology and anatomo-functional correlates in frontal lobe seizures

April 5° 2003
Ospedale Niguarda Cà Granda
Milano-Italy

Scalp EEG in frontal lobe seizures

Paolo Tinuper

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Francesca Bisulli

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Lidia Di Vito

Carlotta Stipa

Veronica Menghi

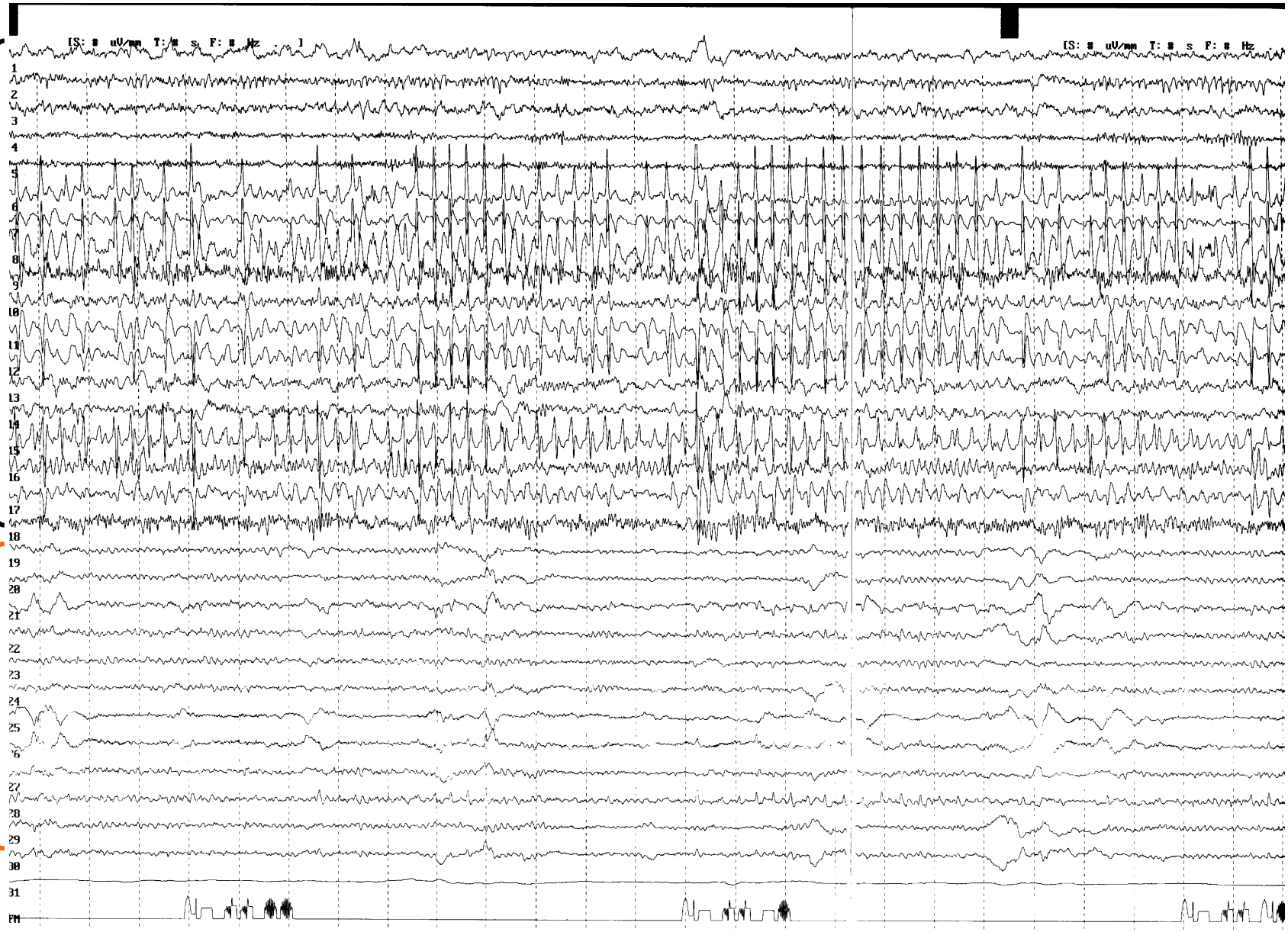
Lorenzo Ferri

Lorenzo Muccioli

Federica Pondrelli

Tecnici EEG

WAKE



SEEG

SCALP

EOG