

# MANIFESTAZIONI E STATO EPILETTICO



# CLINICA E DIAGNOSTICA



**Fabio Minicucci**  
Dipartimento di neurologia  
Ospedale San Raffaele  
Milano

# La neurologia dell'emergenza-urgenza

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Algoritmi decisionali

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A cura di

Giuseppe Micieli   Domenico Consoli   Anna Cavallini  
Roberto Sterzi

## 4. Manifestazioni epilettiche motorie e non motorie

*Coordinatore:* Fabio Minicucci

*Gruppo di lavoro:* Umberto Aguglia,  
Fabrizio Antonio de Falco, Donata Guidetti,  
Oriano Mecarelli, Gian Andrea Ottonello,  
Roberto Michelucci

## ILAE 2015 CLASSIFICAZIONE DEGLI STATI EPILETTICI (SE)

Gli SE devono essere descritti in base a 4 assi

- Semeiologia
- Eziologia
- Caratteristiche EEG
- Età

## ILAE 2015 CLASSIFICAZIONE DEGLI STATI EPILETTICI (SE)

EZIOLOGIA NOTA

Remota

Progressiva

Nell'ambito di sindromi epilettiche definite

Eziologia sconosciuta

## A definition and classification of status epilepticus – Report of the ILAE Task Force on Classification of Status Epilepticus

\*†‡Eugen Trinka, §Hannah Cock, ¶Dale Hesdorffer, #Andrea O. Rossetti, \*\*Ingrid E. Scheffer, ††Shlomo Shinnar, ‡‡Simon Shorvon, and §§Daniel H. Lowenstein

*Epilepsia*, \*\*(\*)1–9, 2015  
doi: 10.1111/epi.13121

TIME IS BRAIN  
VALE ANCHE PER LO  
STATO EPILETTICO ?



## KEY POINTS

- A new conceptual definition of status epilepticus with two operational dimensions ( $t_1$  and  $t_2$ ) is proposed
- Time point  $t_1$  indicates when treatment should be initiated, and time point  $t_2$  indicates when long-term consequences may appear
- The Task Force also proposes a new classification of SE that will provide a framework for clinical diagnosis and therapeutic approaches for each patient

**Table 1. Operational dimensions with  $t_1$  indicating the time that emergency treatment of SE should be started and  $t_2$  indicating the time at which long-term consequences may be expected**

Type of SE	Operational dimension 1 Time ( $t_1$ ), when a seizure is likely to be prolonged leading to continuous seizure activity	Operational dimension 2 Time ( $t_2$ ), when a seizure may cause long term consequences (including neuronal injury, neuronal death, alteration of neuronal networks and functional deficits)
Tonic-clonic SE	5 min	30 min
Focal SE with impaired consciousness	10 min	>60 min
Absence status epilepticus	10–15 min <sup>a</sup>	Unknown

<sup>a</sup>Evidence for the time frame is currently limited and future data may lead to modifications.

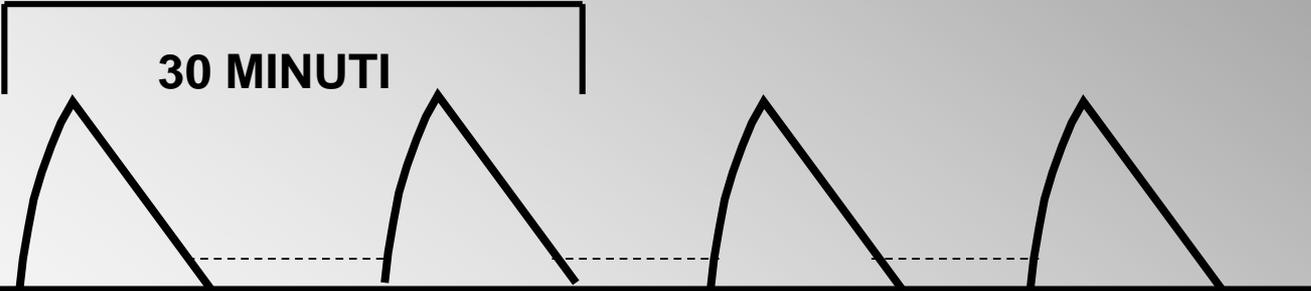
## CONDIZIONE EPILETTICA CONTINUA

> 5-10 MINUTI

A diagram showing a horizontal line with a dashed line above it. A bracket above the dashed line indicates a duration of more than 5-10 minutes.

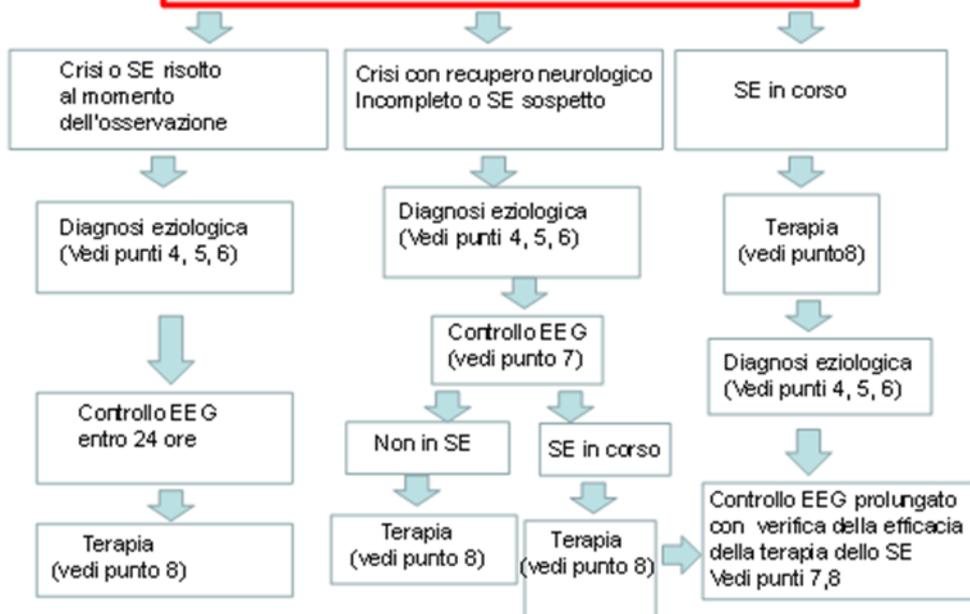
## CRISI MOLTO RAVVICINATE

30 MINUTI

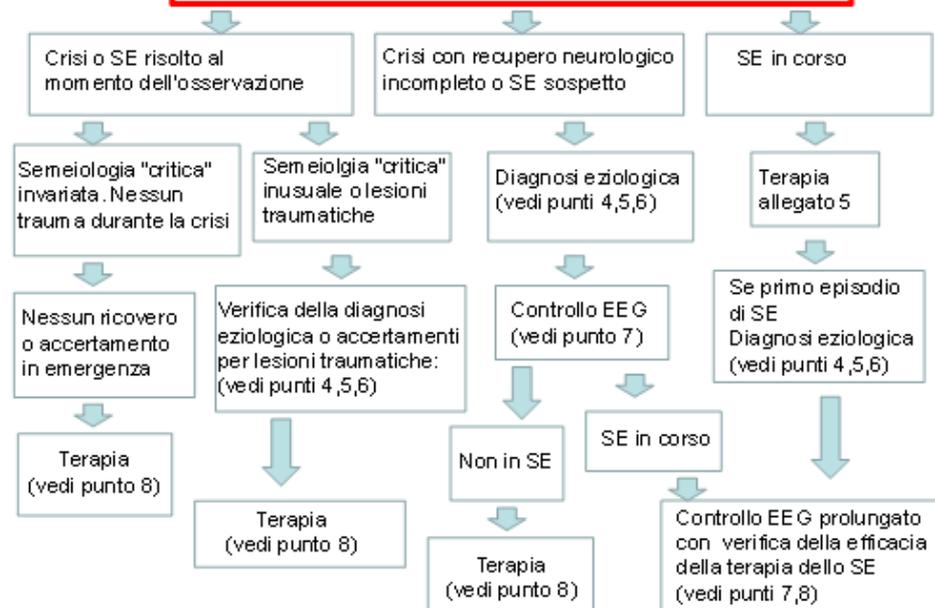
A diagram showing a horizontal line with four triangular waveforms above it. A bracket above the first two waveforms indicates a duration of 30 minutes. A dashed line connects the troughs of the four waveforms.

**DEFINIZIONE DI STATO EPILETTICO**

**PRIMA MANIFESTAZIONE EPILETTICA  
CRISI O STATO EPILETTICO (SE) SINTOMATICO ACUTO O  
SINTOMATICO REMOTO**



**STORIA PRECEDENTE DI EPILESSIA  
CRISI O STATO EPILETTICO (SE) IN EPILESSIA NOTA**



**PRIMA MANIFESTAZIONE EPILETTICA  
CRISI O STATO EPILETTICO (SE) SINTOMATICO ACUTO O  
SINTOMATICO REMOTO**



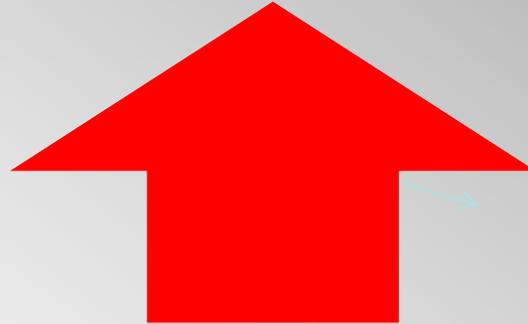
Crisi o SE risolto  
al momento  
dell'osservazione



Crisi con recupero neurologico  
Incompleto o SE sospetto



SE in corso



**Questo è il vero problema**

(+) Filtro PA : 0.53 Hz Filtro PB : 50.0 Hz Ampiezza EEG: 150 microVolt/cm Notch: si

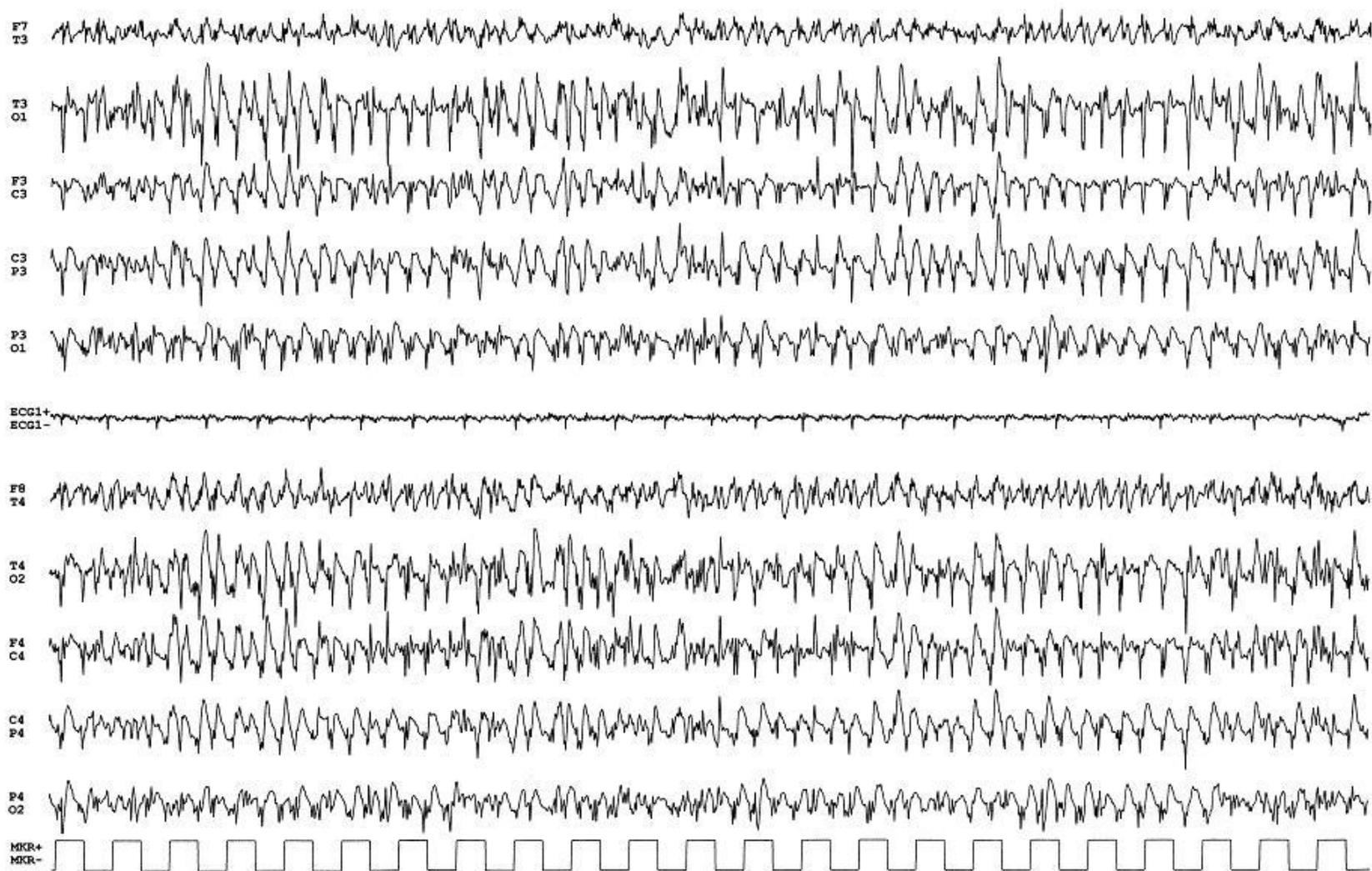
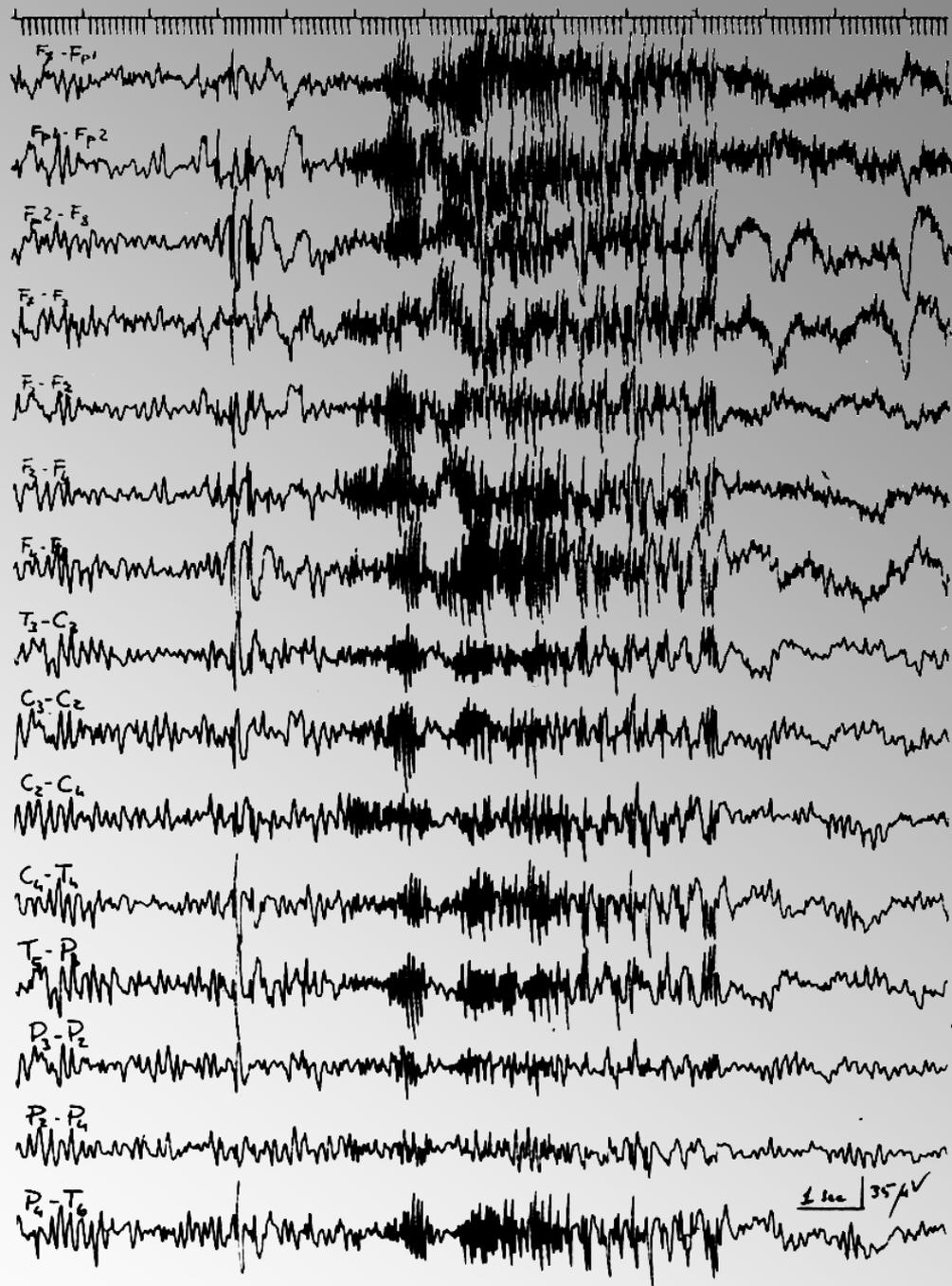
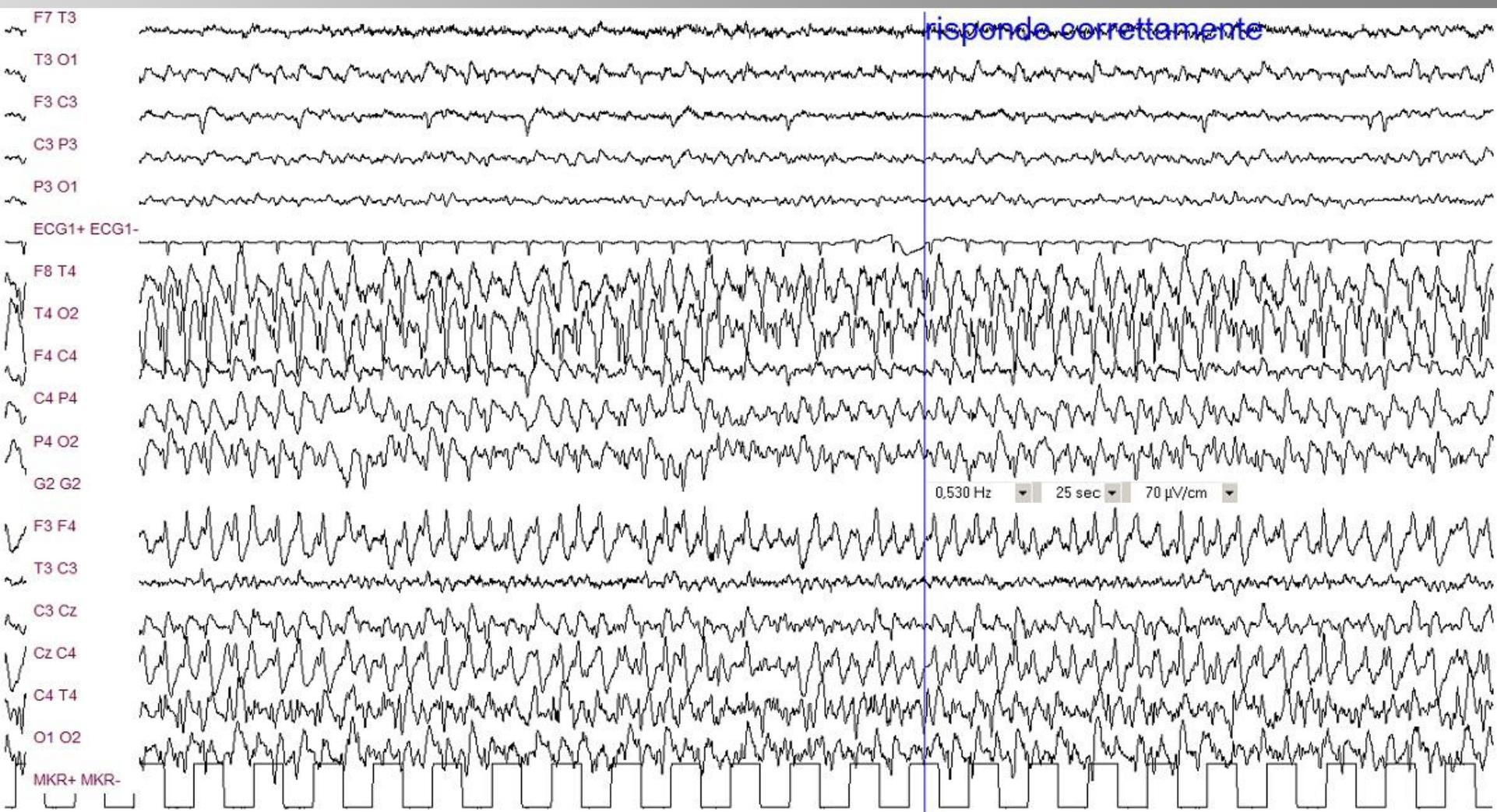
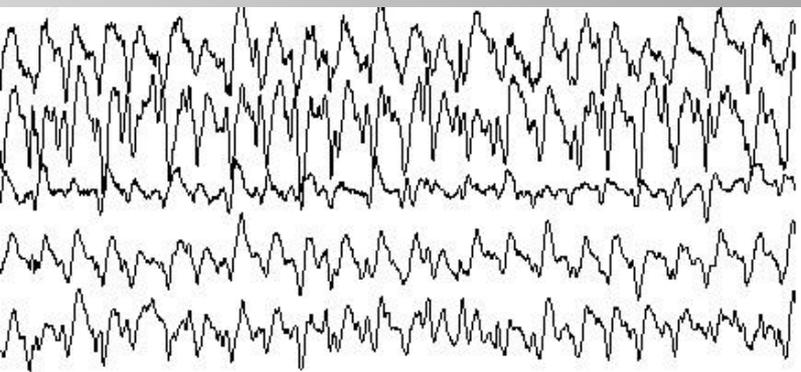


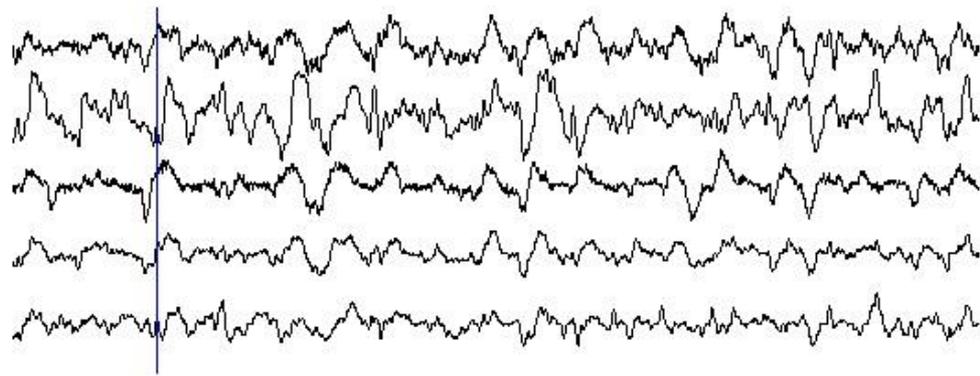
FIG. 9





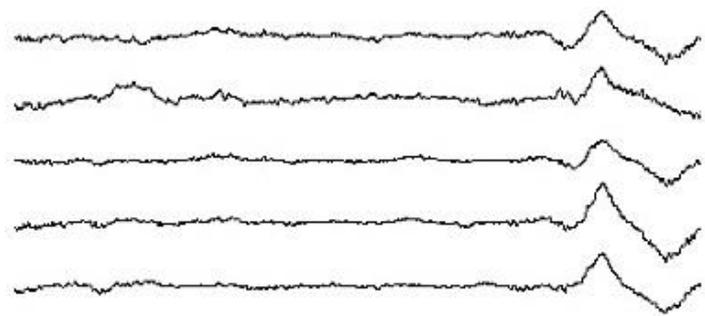


PRIMA



DURANTE

DOPO



# **ELETTROENCEFALOGRAFIA**

**E' l'unico esame strumentale che consenta di confermare l'ipotesi anamnestica e clinica di episodio epilettico risolto o ancora in corso.**

**FONDAMENTALE PER**

- DIAGNOSI DI STATO EPILETTICO NON CONVULSIVO**
- VERIFICA DEI RISULTATI DEL TRATTAMENTO**

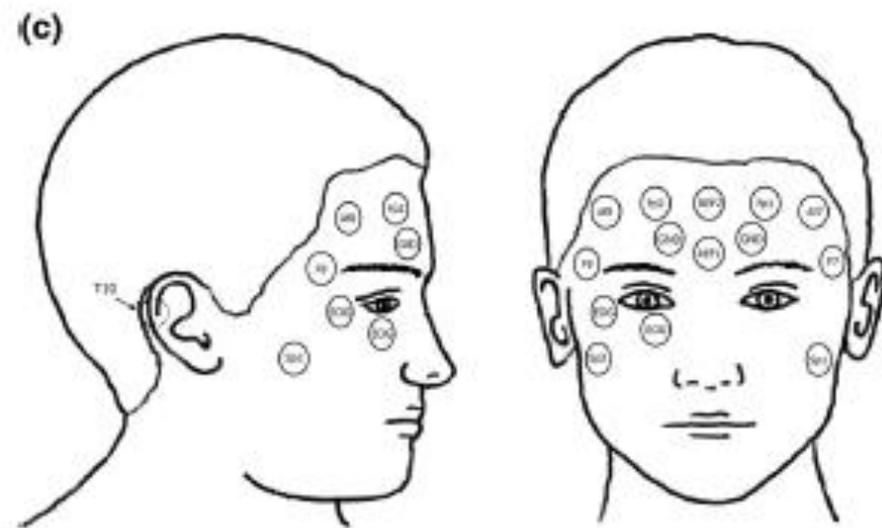
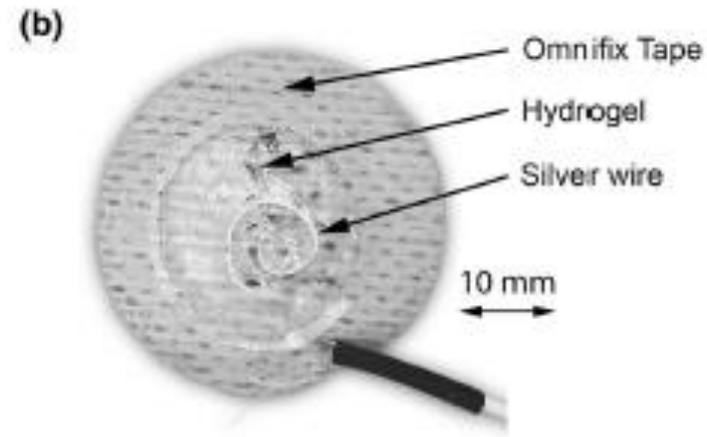
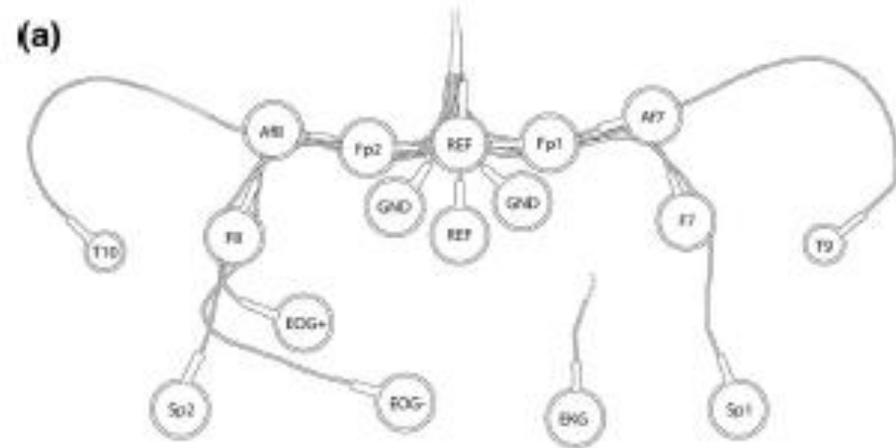
**Per escludere una diagnosi di SE non convulsivo è sufficiente una registrazione di 30 minuti.**

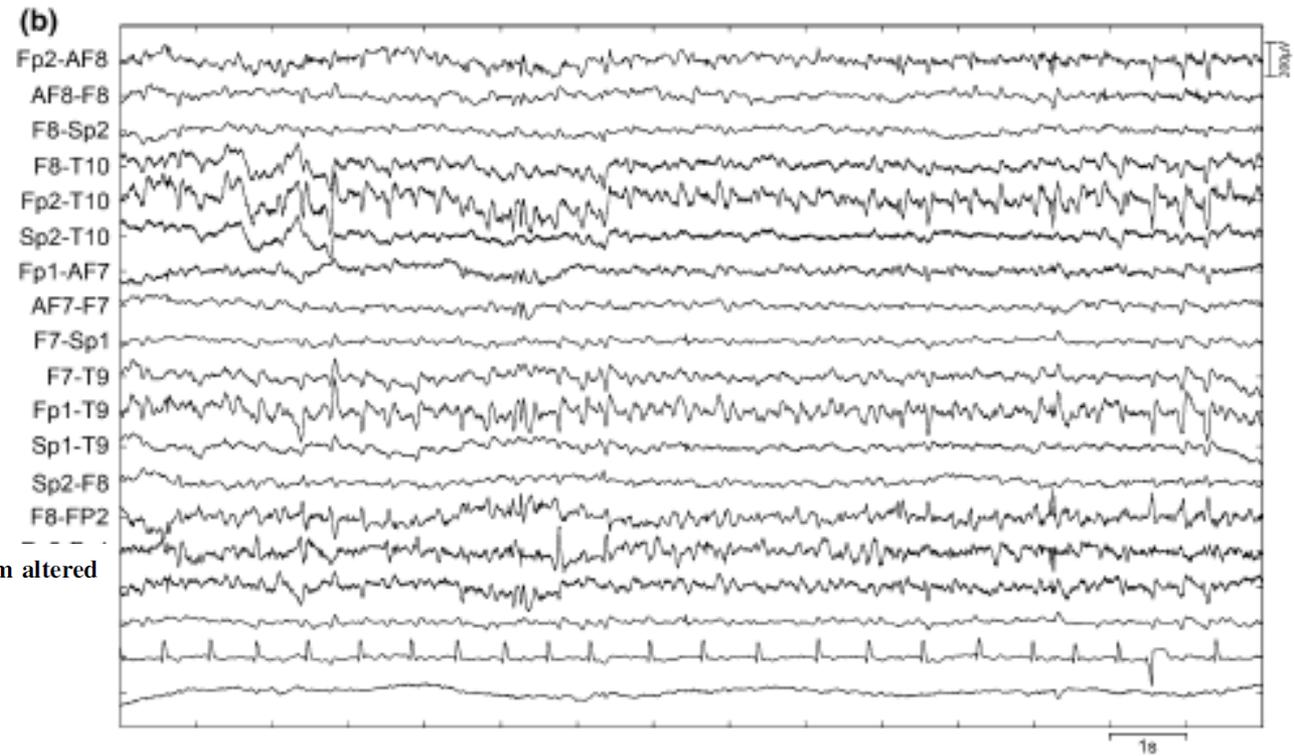
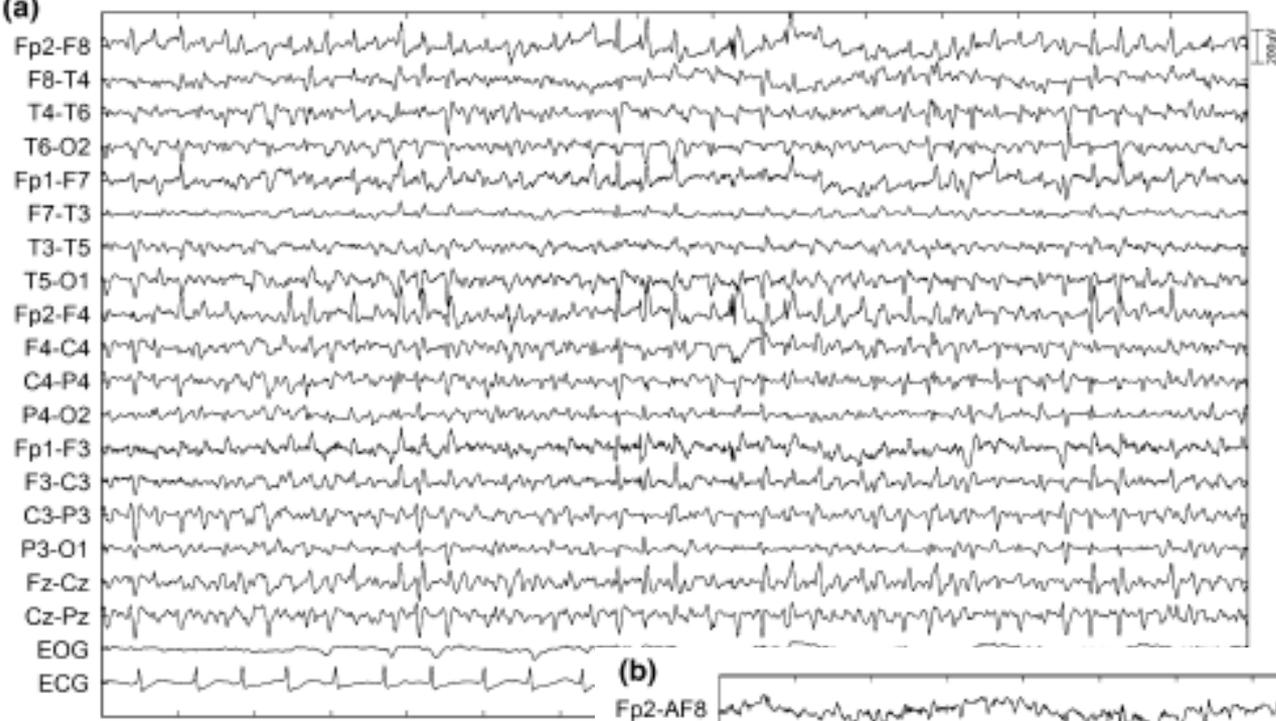
**Per verificare il risultato della terapia non possono essere messi in preventivo tempi di esecuzione e, nelle strutture in grado di farlo, è suggerito un monitoraggio prolungato fino a risoluzione del problema.**

# A Handy EEG Electrode Set for patients suffering from altered mental state

Pasi Lepola · Sami Myllymaa · Juha Töyräs ·  
Taina Hukkanen · Esa Mervaala · Sara Määttä ·  
Reijo Lappalainen · Katja Myllymaa

*J Clin Monit Comput* (2015) 29:697–705





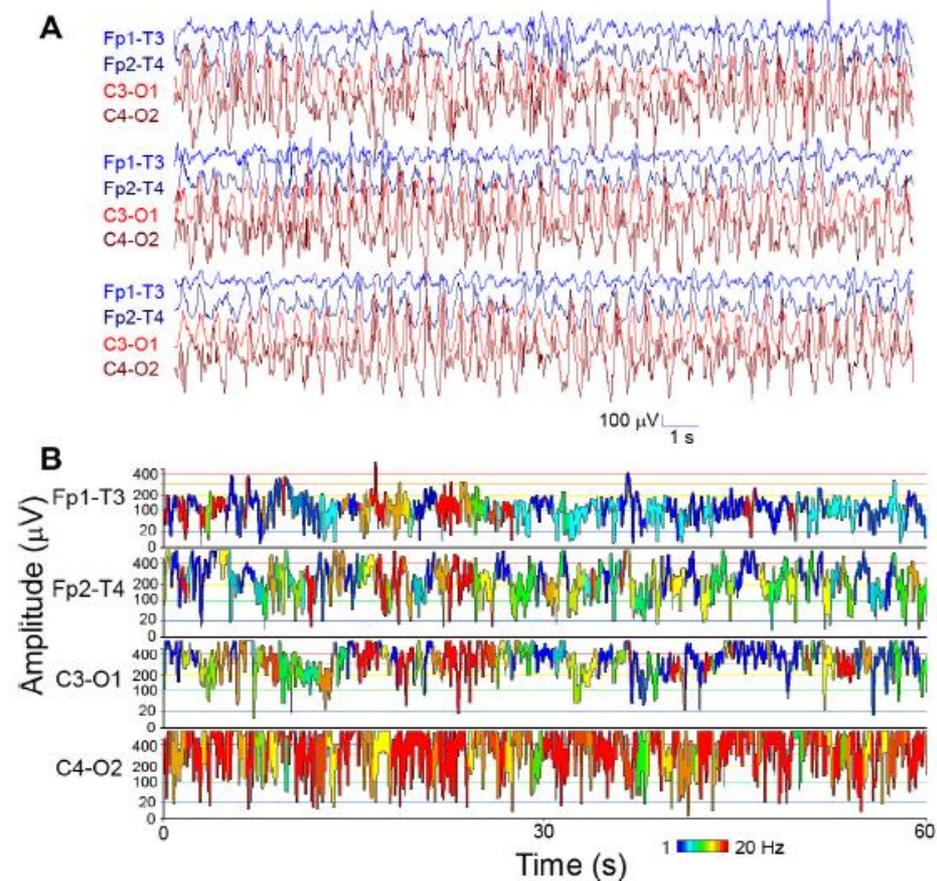
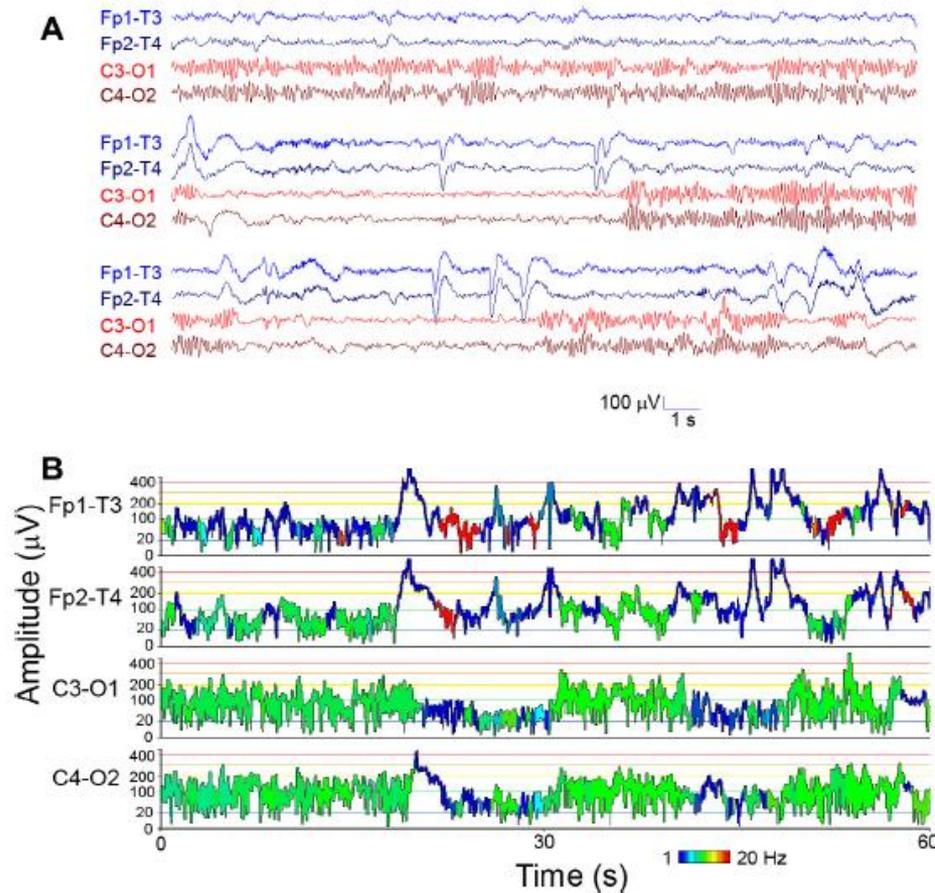
A Handy EEG Electrode Set for patients suffering from altered mental state

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Reijo Lappalainen · Katja Myllymaa

# Trend figures assist with untrained emergency electroencephalogram interpretation

Brain & Development 37 (2015) 487–494

Katsuhiro Kobayashi<sup>a,\*</sup>, Kosuke Yunoki<sup>b</sup>, Kazumasa Zensho<sup>b</sup>, Tomoyuki Akiyama<sup>a</sup>, Makio Oka<sup>a</sup>, Harumi Yoshinaga<sup>a</sup>



tern; in the other patterns, misjudgments were equally low for the trend figures and the raw traces. *Conclusion:* EEG trend figures improved the accuracy with which untrained medical staff interpreted emergency EEGs. Emergency EEG figures that can be understood intuitively with minimal training might improve the accuracy of emergency EEG interpretation. However, additional studies are required to confirm these results because there may be many types of clinical EEGs that are difficult to interpret.

*The* NEW ENGLAND  
JOURNAL *of* MEDICINE

ESTABLISHED IN 1812

FEBRUARY 16, 2012

VOL. 366 NO. 7

Intramuscular versus Intravenous Therapy for Prehospital  
Status Epilepticus

Robert Silbergleit, M.D., Valerie Durkalski, Ph.D., Daniel Lowenstein, M.D., Robin Conwit, M.D.,  
Arthur Pancioli, M.D., Yuko Palesch, Ph.D., and William Barsan, M.D., for the NETT Investigators\*

This double-blind, randomized, noninferiority trial compared the efficacy of intramuscular midazolam with that of intravenous lorazepam for children and adults in status epilepticus treated by paramedics. Subjects whose convulsions had persisted for more than 5 minutes and who were still convulsing after paramedics arrived were given the study medication by either intramuscular autoinjector or intravenous infusion. The primary outcome was absence of seizures at the time of arrival in the emergency department without the need for rescue therapy. Secondary outcomes included endotracheal intubation, recurrent seizures, and timing of treatment relative to the cessation of convulsive seizures. This trial tested the hypothesis that intramuscular midazolam was noninferior to intravenous lorazepam by a margin of 10 percentage points.

**TABLE 1.** EEG and Clinical Characteristics of the Periodic Discharges

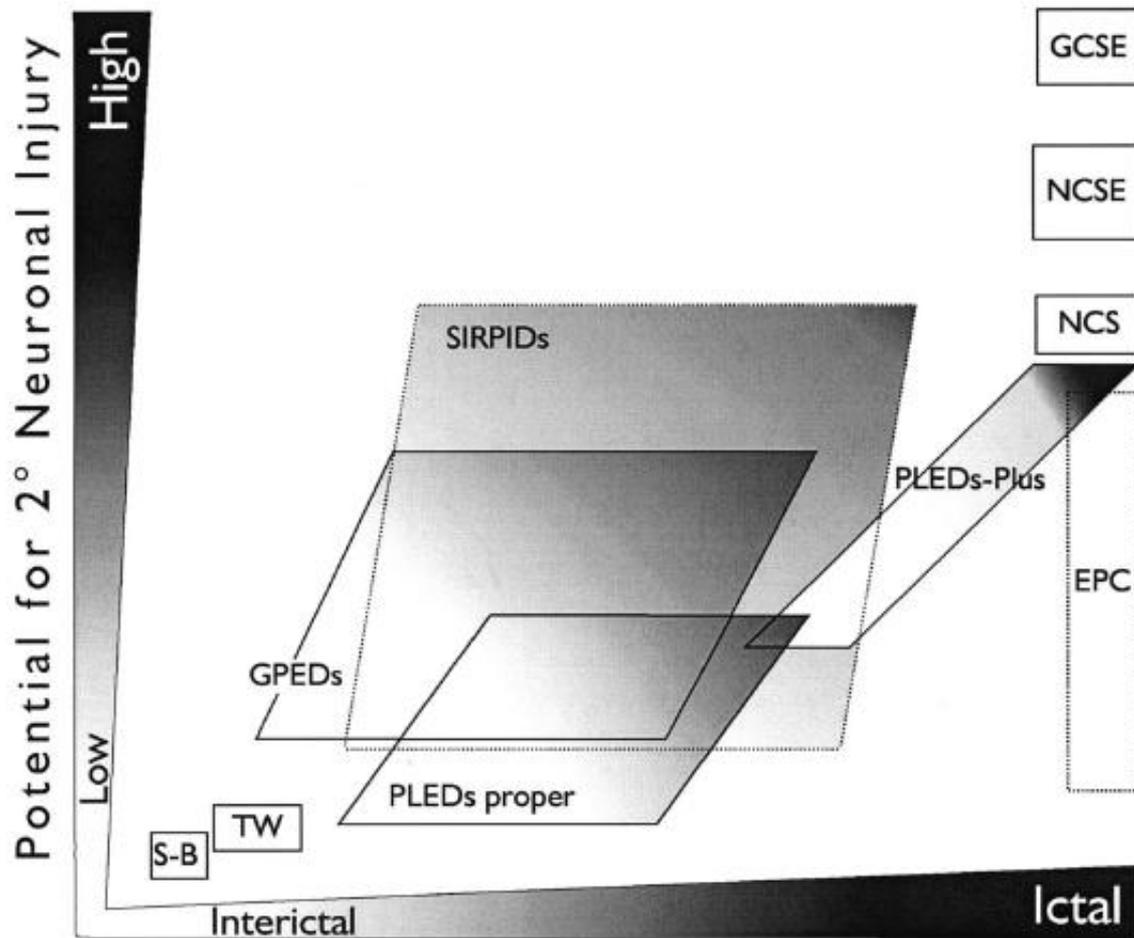
	PLEDs	BIPLEDs	GPEDs	
			PSIDDs	PLIDDs
Inter-discharge interval	Typical: 0.5 to 4 s, up to 8 s	Typical: 0.5 to 4 s, up to 8 s	0.5–4 s	4–30 s
Topography	Lateralized (contralateral spread common)	Independently lateralized	Diffuse	Diffuse
Rate of focal or tonic-clonic seizures	High, approximately 80%	Typically lower than in PLEDs but still high	Variable/unclear but not rare	Rare
Associated myoclonus	Rare	Rare	Common with CJD but often not time-locked	Common with SSPE, time-locked
Mental status	Altered	Altered	Altered	Variable
Outcome*	Variable*	Variable*	Variable*	Variable*
Morphology/other characteristics	Morphology variable. Associated with EPC	Morphology variable	Sharp waves, spikes, polyspikes, or sharply-contoured delta waves	Variable; often complex, stereotyped, polyphasic bursts, lasting 0.5–3 s
Etiology	Acute structural lesion: Infarct, ICH, tumor, infection; occasionally no lesion. After SE. Increased risk with metabolic disturbance. <b>HSE</b>	Anoxia, bilateral acute lesions. Occasionally unilateral or no lesion apparent. <b>HSE</b>	Metabolic encephalopathy, anoxia. <b>NCSE</b> . After SE. Lithium, baclofen, <b>CJD</b>	Toxins (PCP, ketamine barbiturates, anesthetics), anoxia <b>SSPE</b>

Abbreviations: BIPLEDs bilateral independent periodic lateralized epileptiform discharges; CJD Creutzfeldt-Jakob disease; EPC epilepsy partialis continua; GPEDs generalized periodic epileptiform discharges; HSE herpes simplex encephalitis; ICH intracerebral parenchymal hemorrhage; NCSE, nonconvulsive status epilepticus; PCP phencyclidine; PLEDs periodic lateralized epileptiform discharges; PLIDDs periodic long interval diffuse discharges; PSIDDs periodic short interval diffuse discharges; SE status epilepticus; SSPE subacute sclerosing panencephalitis. The most important diagnoses to consider are in bold.

\*Outcome appears more highly correlated with etiology than with appearance of the periodic discharges.

Adapted from (Brenner and Schaul 1990 and Fisch 1999)

## The Ictal-Interictal-Injury Continuum



**FIGURE 5.** This plot demonstrates various clinicoelectrographic diagnoses depicted on the ictal-interictal continuum. The potential for secondary (2°) neuronal injury, shown on the y-axis, should be a more important indicator of whether treatment should be aggressive. This figure represents our current understanding of electroclinical entities along two distinct dimensions. The placement of each entity on the graph is approximate and conceptual, with further study required to improve precision and accuracy. Note that if clinical correlate is present with any of the patterns, it would be considered ictal by definition, though this does not necessarily suggest an appreciable increase in the likelihood of neuronal injury. EPC, epilepsy partialis continua; GCSE, generalized convulsive status epilepticus; GPEDs, generalized periodic epileptiform discharges; NCS, nonconvulsive seizures; NCSE, nonconvulsive status epilepticus; PLEDs, periodic lateralized epileptiform discharges; S-B, suppression-burst; SIRPIDs, stimulus-induced rhythmic, periodic, or ictal discharges; TW, triphasic waves.

*Journal of Clinical Neurophysiology*  
16(4):341-352, Lippincott Williams & Wilkins, Inc., Philadelphia  
© 1999 American Clinical Neurophysiology Society

# Assessing the Outcomes in Patients With Nonconvulsive Status Epilepticus: Nonconvulsive Status Epilepticus Is Underdiagnosed, Potentially Overtreated, and Confounded by Comorbidity

Peter W. Kaplan

*Department of Neurology, Johns Hopkins Bayview Medical Center, Baltimore, Maryland, U.S.A.*

# Multimodal MRI assessment of damage and plasticity caused by status epilepticus in the rat brain

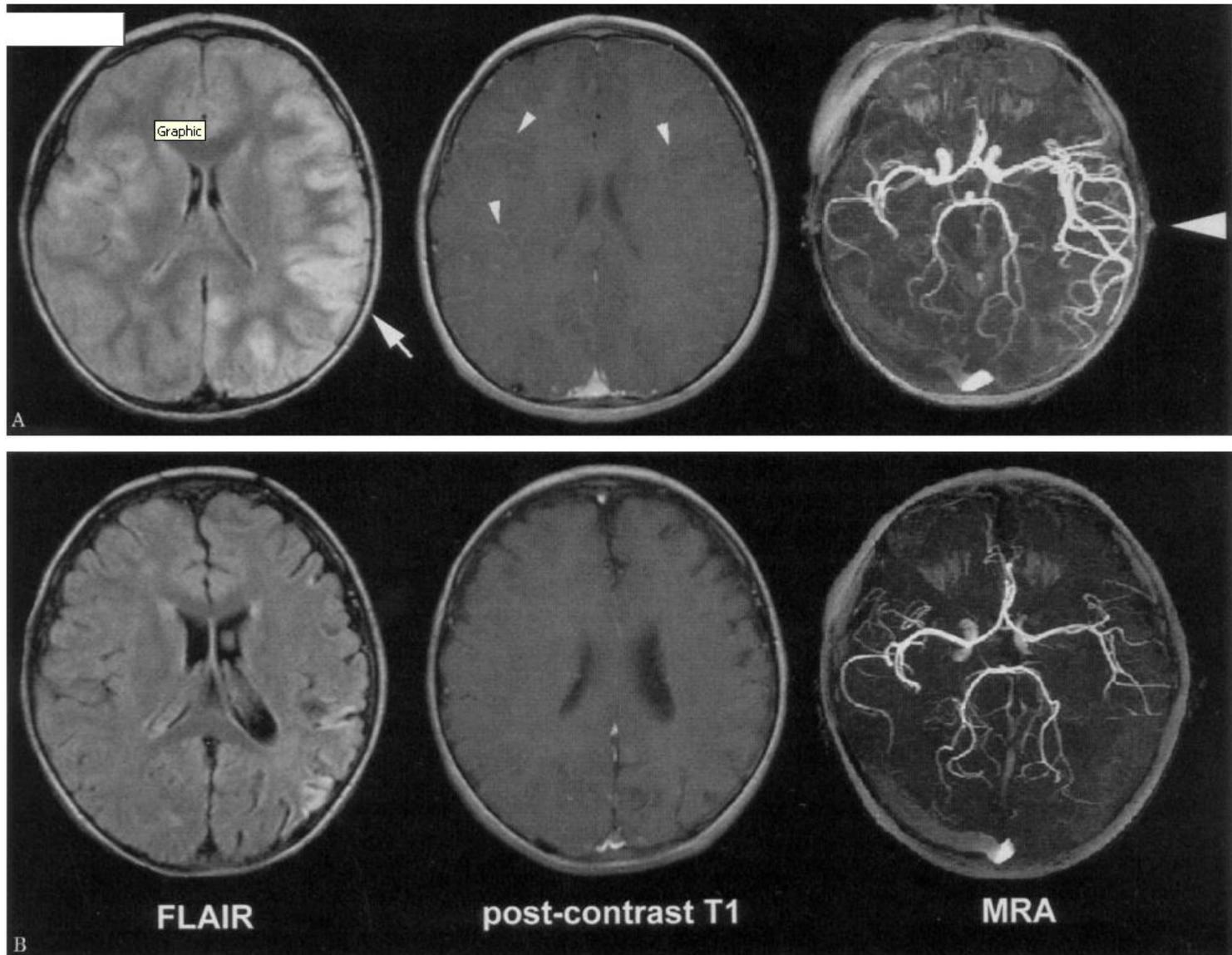
\*Olli Gröhn, \*Alejandra Sierra, \*Riikka Immonen, \*Teemu Laitinen,  
\*Kimmo Lehtimäki, \*Antti Airaksinen, \*Nick Hayward, \*Jaak Nairismagi,  
\*Lauri Lehto, and †‡Asla Pitkänen

*Epilepsia*, 52(Suppl. 8):57–60, 2011  
doi: 10.1111/j.1528-1167.2011.03239.x

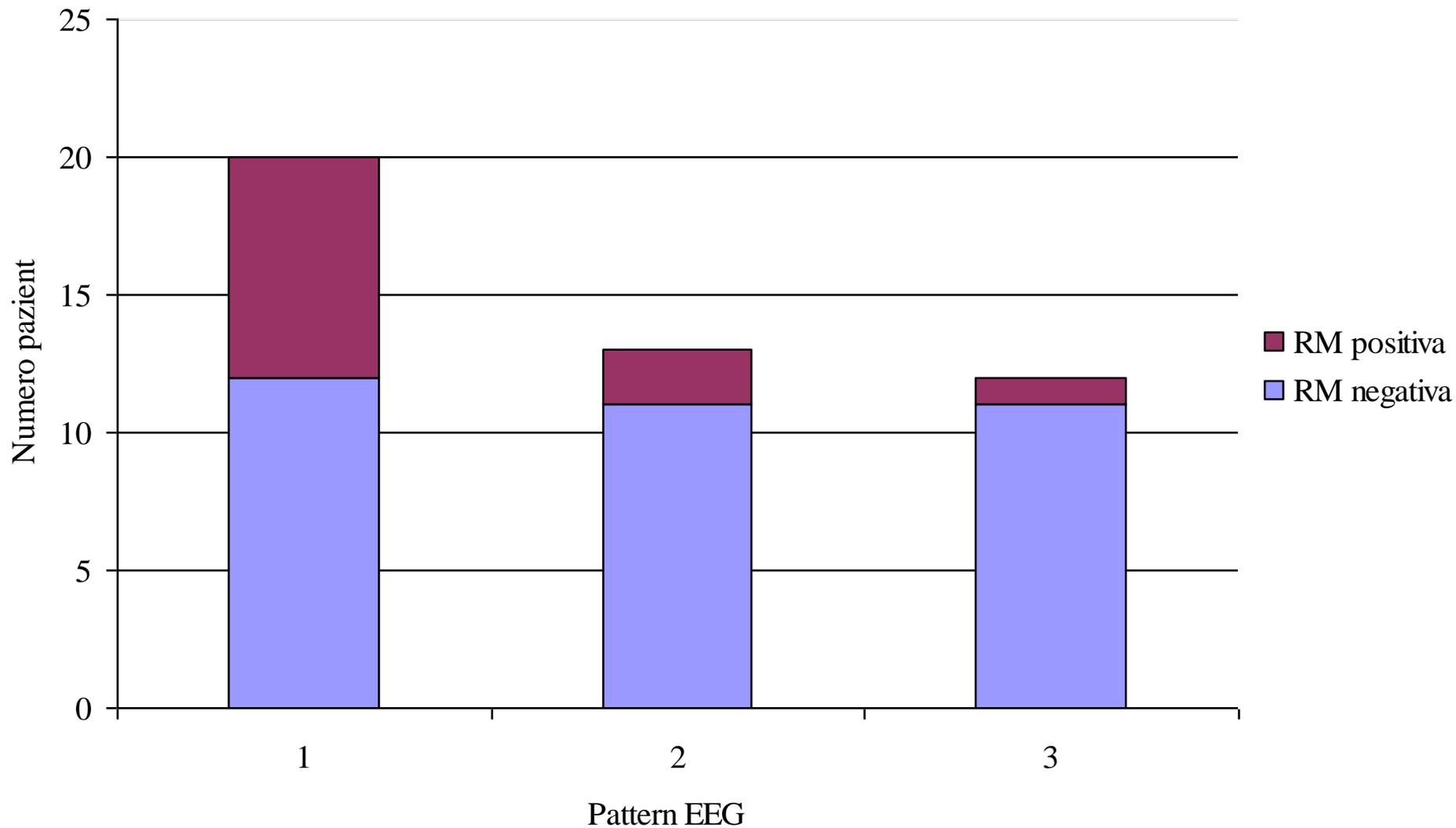
## A range of MRI techniques that have been used, or have potential to be used, to detect changes after status epilepticus in rat

T <sub>2</sub> -weighted MRI	Vasogenic edema, peaks 24–48 h after SE Secondary increase in signal intensity weeks-months after SE Atrophy, enlarged ventricles
Diffusion (mean diffusivity)	Detection of cytotoxic edema in the acute phase (decreased diffusion) Increased diffusion weeks to months after status epilepticus
Diffusion tensor imaging	Axonal plasticity and reorganization Axonal and/or myelin damage When combined with TBSS—identification of novel brain areas associated with epileptogenesis/epilepsy
MEMRI	Axonal reorganization
fMRI	Seizures Potentially: functional plasticity
Arterial spin labeling	Detection of hypo/hyperperfusion, coupled with metabolic demand
CBV-MRI using intravascular contrast agent	Structural changes in vascularization
SWI, phase imaging	Calcifications Potentially: myelinization and vascularization changes

MEMRI, manganese-enhanced MRI; CBV, cerebral blood volume; fMRI, functional MRI; SWI, susceptibility weighted imaging.



**Figure 2.** Fluid-attenuated inversion recovery (FLAIR), postcontrast MRI, and MR angiography images of Patient 3 during status epilepticus (A) and at 2-month follow-up (B). Cortical hyperintensity on FLAIR (arrow), leptomeningeal enhancement on postcontrast MRI (arrowheads), and marked asymmetry of the middle cerebral artery branches on MR angiography (large arrowhead) are seen during status epilepticus. At follow-up these abnormalities have reversed except for a small residual region of cortical hyperintensity on FLAIR.

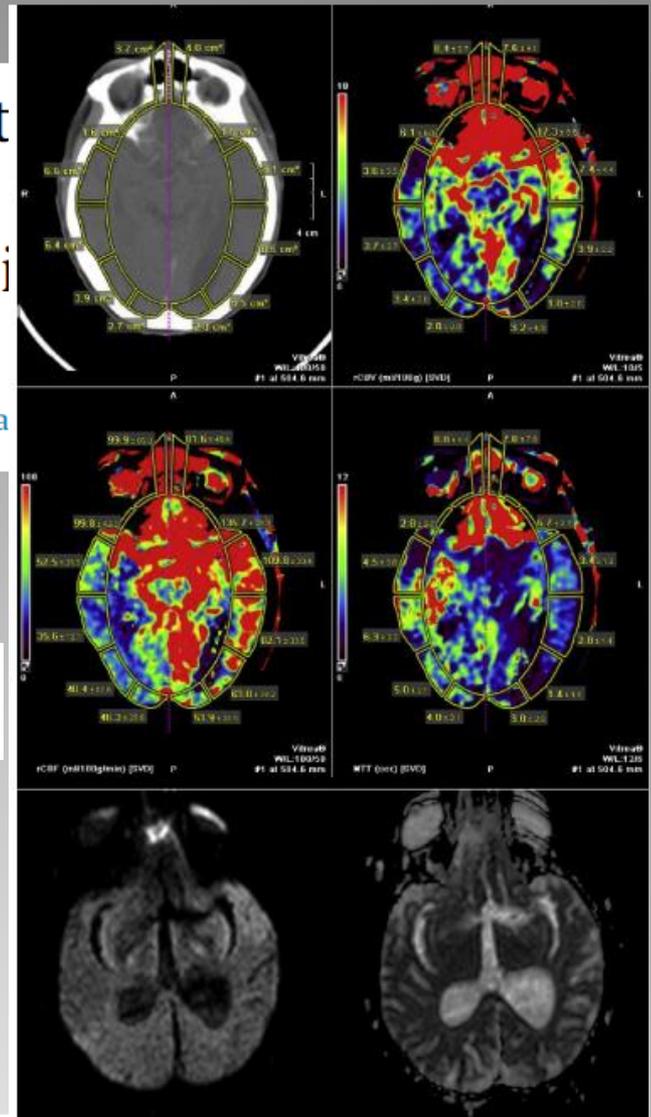


1 = crisi singole, 2 = anomalie epilettiformi continue, 3 = anomalie periodiche. RM positiva/negativa = presenza/assenza, alla RM, di lesioni compatibili con alterazioni da SE (vedi testo per dettagli).

# Acute CT perfusion changes in seizure patients presenting to the emergency department with stroke-like symptoms: correlation with clinical and electroencephalography findings☆

S. Payabvash<sup>a,b</sup>, M.C. Oswood<sup>a</sup>, C.L. Truwit<sup>a</sup>, A.M. McKinney<sup>a</sup>

**Figure 1** CTP image of a 55-year-old man with a history of seizure, 13 hours following right-sided extremity weakness and aphasia. CTP examination demonstrated left temporal lobe hyperperfusion. EEG the next morning showed left anterior temporal spikes and asymmetric fast activity in the left paracentral areas. An MRI performed 48 hours after the symptom presentation showed no evidence of restricted diffusion or recent ischaemic stroke.



**CONCLUSION:** Seizure patients who present with a unilateral motor or speech deficit most commonly have contralateral hyperperfusion in the corresponding eloquent brain regions on the acute-stage CTP examination. In such patients, epileptiform discharges on the early follow-up EEG are associated with ipsilateral hyperperfusion on the admission CTP.

# LA REALTA'

Nella pratica clinica si vedono pazienti in SE:

- parziale
- non convulsivo (con conseguente ritardo nella diagnosi)
- con terapie precedenti più o meno a dosi adeguate
- con una patologia sottostante acuta che determina sintomi confondenti
- che non verranno mai presi in TI
- sulla cui diagnosi i vostri colleghi non esperti di EEG avranno dei dubbi
- **sulla cui terapia voi avrete spesso un dubbio:  
“fino a che punto devo insistere?”**

# Champ 3- place de l'EEG dans l'état de mal épileptique<sup>☆</sup>

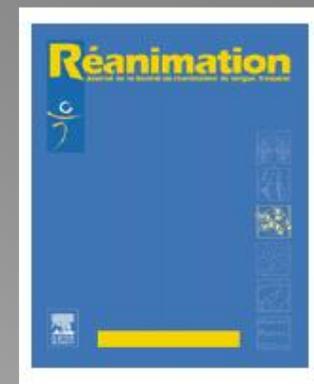
## The EEG in status epilepticus

V. Navarro<sup>a,\*</sup>, N. Engrand<sup>b</sup>, P. Gélisse<sup>c</sup>

<sup>a</sup> *Unité d'épileptologie, département de neurophysiologie clinique, hôpital de la Pitié-Salpêtrière, 47–83, boulevard de l'Hôpital, AP–HP, Paris, France*

<sup>b</sup> *Département d'anesthésie réanimation, fondation ophtalmologique Rothschild, Paris, France*

<sup>c</sup> *Unité médicochirurgicale de l'épilepsie, hôpital Gui-de-Chauliac, Montpellier, France*



**Summary** Recording electroencephalogram (EEG) has a major place in the management of patients with status epilepticus (SE). EEG contributes to SE diagnosis (findings regarding syndrome and etiology as well as differential diagnoses) and is helpful in the patient management and follow-up. EEG interpretation in a patient with refractory SE is difficult. Thus, it should be performed by experienced clinicians. We discuss the different modalities of EEG recording and their emergency indications.

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# Conclusioni

Perché la diagnosi e il trattamento dello stato epilettico sia fatta correttamente serve:

- La possibilità di una copertura continua del servizio EEG
- Lo sviluppo di una ricerca dedicata all'integrazione EEG-diagnostica per immagini per coprire l'area grigia della diagnosi di tutte le condizioni Stato epilettico
- Una rivalutazione didattica dell'elettroencefalografia