جایگاه نوار مغز در تشخیص تشنج وصرع

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اهداف

- استفاده از نوار مغزی برای تشخیص تشنج و صرع
- آشنایی با حساسیت و ویژگی نوار مغزی در تشخیص تشنج
- اصول درخواست نوار مغزی
- تفسیر داده ها در زمینه بالینی

استفاده از نوار مغزی برای تشخیص تشنج و صرع

۱. ایا حمله تشنج بوده است؟

۲.ریسک عود حمله بعدی چقدر است؟

۳.نوع تشنج چه بوده است (فوکال یا ژنرالیزه)؟

۴.نوع سندرم صرعی چیست؟

سناریوی بالینی

- کودک ۵ ساله به علت حمله ای که داشته است به اورژانس اورده شده است. مادر می گوید ساعت ۱۰ شب کودک در اطاق خود خوابید یک ساعت بعد به جهت صدای ناله مانند که از اطاق کودک می امد به اطاق وی رفتند متوجه شدند که یک طرف صورت کودک حرکات پرشی دارد ابریزش از دهان دارد و نمی تواند حرف بزند ولی دست مادر را فشار میدهد . حمله ۲ دقیقه طول کشید. بعد از حمله کودک هوشیار بود وگفت که متوجه وقایع اطراف خود بود ولی نمیتوانست حرف بزند. مادر میگوید که ان شب در حضور کودک مشاجره خانوادگی داشته اند و کودک ترسیده بود. تکامل نرمال داشته است. سابقه نوزادی و تروما منفی است.سابقه تشنج درفامیل ندارند.

The value of routine EEG for the diagnosis of seizures and epilepsy

- The routine EEG, lasting 20-30 minutes, is the most basic and inexpensive EEG test, and can support a diagnosis of epilepsy.
- The principal objective of the routine EEG, in the diagnosis of epilepsy, is to capture IEDs.

EEG in the diagnosis of Epilepsy

- Sensitivity
- Specificity
- Pitfalls

EEG in the diagnosis of Epilepsy

Sensitivity

In what % of subjects suffering from one specific affliction (i.e.: epilepsy) is a specific sign, symptom, lab finding, etc. (i.e.: epileptiform EEG), specifically correlated with that one affliction actually found.

Sensitivity of Interictal Epileptiform Discharges (IEDs)

- **Sensitivity of the routine EEG to reveals IEDs depends on :**
  - Epilepsy type : for example Lennox-Gastaut syndrome v.s frontal lobe epilepsy
  - Age
  - Activating procedure : HV. IPS , state of patient, sleep deprivation
  - Focal v.s generalized epilepsy,
  - Seizure frequency,
  - Proximity of the EEG to recent seizure activity,
  - Additional electrodes

Sensitivity of interictal Epileptiform Discharges (IEDs)

- Generally, the sensitivity of routine EEG is around 50% for the initial EEG and increases to 82-92% with repeated studies.
- Others found that only 36% of patients had IEDs within the first 20 minutes of long-term monitoring, while 89% had IEDs in the first 24 hours.

Cumulative " yield "
(positive finding of epileptiform activity in EEG)

	% patients with epilepsy
Single ~~routine~~ standard EEG	**50**
+ additional sleep EEG	**80**
+ multiple awake & sleep recordings	**92**
Consistent negative findings	**8**

Sensitivity of interictal Epileptiform Discharges (IEDs)

- Epileptic activity is not equally distributed over time
- Circadian and diurnal variation
- Different for different epilepsy syndromes
- When ordering repeat studies
  - choose different time block
  - try for a sleep promoting setting
  - notably in infants and young children
  - time of normal nap; post feeding

EEG in the diagnosis of Epilepsy

Specificity

What % of the subjects in whom a specific sign, symptom, lab-finding, etc. (i.e.: epileptiform EEG), correlated with one specific affliction (i.e.: epilepsy), is found does actually have that affliction.

Epileptiform activity in EEG of healthy adults

Awake routine EEG	E.A.	specificity
Gibbs et al. (1943); 1000 subjects	0.9%	99%
Robin et al. (1978): 7500 pilots;	0.34%	99%
Gregory et al. (1993): 13650 pilots	0.5%	99%
Drowsiness		
Santamaria & Chiappa (1987): 55 subjects	30%	?
Full night sleep		
Beun et al. (1997): 60 subjects	70 (97)%	?

Epileptiform activity in EEG of family members of epileptic patients

Lennox et al, 1946, 1947

470 first degree relatives of seizure pts. with generalized E.A.

Abnormal EEG	80%
Epileptiform discharges	10%
Seizures	3%

Epileptiform activity in EEG of assorted subjects

Zivin & Aimone Marsan (1968): 6500 neurological patients: 2.2%

Mental retardation	30%
Congenital / perinatal brain injury	24%
Cranial surgery	12%
Cerebral tumor	10%

(14% of patients with E.A.: later epilepsy)

Bridgers (1987): 3000 psychiatric patients (no epilepsy) 2.7%

Psychiatric patients with epilepsy	37%

Abnormal EEG after a first unprovoked seizure

TABLE 1. *Distribution of seizure types in 321 children with EEG available*

	Idiopathic		Remote symptomatic	
Seizure type	Overall n	Abnormal EEG n (%)	Overall n	Abnormal EEG n (%)
Generalized seizures	173	51 (29)	24	14 (58)
Tonic-clonic	151	46 (30)	18	12 (67)
Atypical absence	5	3 (60)	2	0 (0)
Atonic	17	2 (12)	4	2 (50)
Partial seizures	95	52 (55)	29	18 (62)
Simple partial	5	4 (80)	1	1 (100)
Complex partial	26	20 (77)	6	5 (83)
Secondarily generalized	64	28 (44)	22	12 (55)
Total	268	103 (38)	53	32 (60)

Idiopathic: Normal EEG in 60%

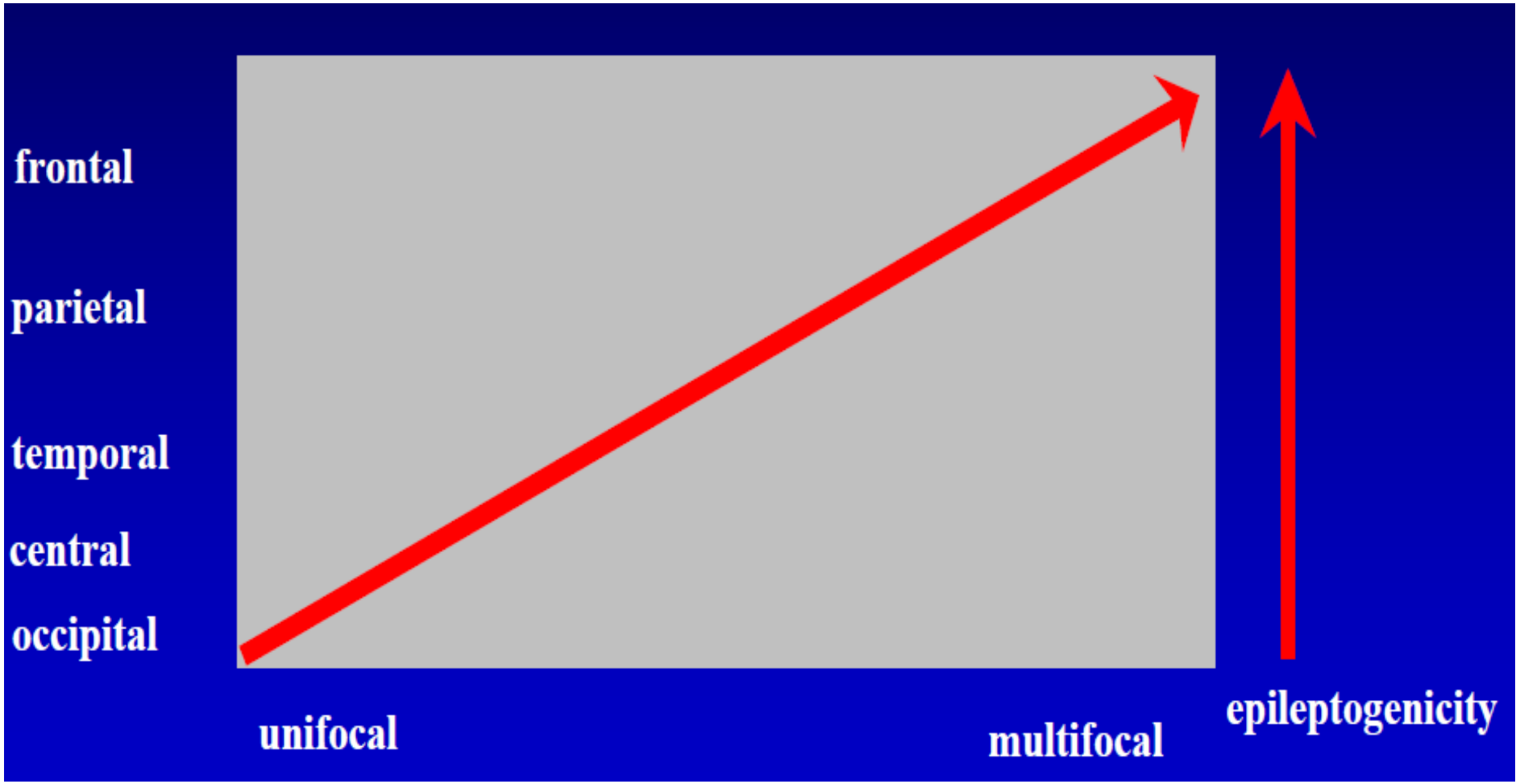
Remote symptomatic: Normal EEG in 40%

EEG Abnormalities in Children with a First Unprovoked Seizure

*†‖Shlomo Shinnar, *†Harriet Kang, §Anne T. Berg, *Eli S. Goldensohn, ‖W. Allen Hauser, and *†‡Solomon L. Moshé

Epilepsia, 35(3):471–476, 1994

Clinical epileptogenic relevance of spikes



Specificity of IEDs

- The "over-reading" of the EEG is often the cause of the misdiagnosis of epilepsy even if the patient's history is not particularly suggestive of epilepsy.
- High potential for incorrect use, misuse or abuse.

Epileptic and non-epileptic paroxysmal EEG patterns

- Spike
- (Poly) spike and wave
- Sharp wave
- Sharp and slow wave
- Hypsarrhythmia
- 14 & 6 Hz positive spikes
- Benign Epileptiform Transient Sleep
- 6 Hz occipital phantom spike waves
- 5-6 Hz mid-temporal psychomotor variant discharge
- Wicket spikes
- Vertex waves
- POSTS

Interictal epileptiform discharge patterns

- 3Hz generalized spike and wave discharges
- Anterior / basal (fronto) temporal spikes (& delta)
- Hypsarrhythmia
- 4-6 Hz anterior or generalized (poly)spike and wave discharges
- Generalized spike and waves provoked by photic stimulation

Interictal epileptiform discharge patterns

- Fast isolated spikes, including occipital and central spikes
- Centro-temporal spikes
- Posterior sharp transients, provoked by photic stimulation

Operational Definition of Epilepsy

- Two or more unprovoked (or reflex seizure) > 24 hours apart;
- One unprovoked (or reflex) seizure and at least 60% probability of seizure recurrence within the next 10 years;
- Diagnosis of an Epilepsy Syndrome.

One unprovoked (or reflex) seizure and of seizure recurrence within the next 10 years at least 60% probability

Very few reliable “biomarkers” to decide on this >60%

•Clinical setting (trauma, infection, etc.)

•Family history (Genetics)

•EEG

Spike &Wave more predictive than spike but even Spike&Wave only predictive if it fits with clinical history, seizure type, genetics, age, clinical state, etc.

Video documentation of clinical behavior / events

- ☑ In clinical setting or at home
- ☑ Often very valuable for clinical diagnosis & management
- ☑ Home video major advance in pediatrics
- ☑ Cheap and reliable
- ☑ Lack of EEG often not a problem
- ☑ Is not EEG – Video Monitoring !

Some major intrinsic limitations of traditional EEG in the diagnosis of epilepsy (and other disorders)

- Relatively insensitive for non-convexity or deep lying activities
- Limited spatial resolution (6 cm2 of activated cortex)
- Sampling bias for non-continuous phenomena
- Limitations of recording montages
- Limitations of visual analysis

Major extrinsic limitations of traditional EEG in the diagnosis and management of epilepsy

- Insufficient knowledge of specific EEG aspects of epilepsy
- Insufficient understanding of intrinsic limitations of EEG
- Inadequate recording methodology
- Obsessive preoccupation with “epileptiform” phenomena
- (Total) disregard for non-epileptiform phenomena

EEG in the diagnosis and management of epilepsy in children special pediatric aspects

Sensitivity – Specificity

- **Dependent on age – neurological state – syndrome**
- **5 % of normal children of school age: spikes / spike & waves**

  more during sleep / drowsiness

  much more in case of cerebral pathology

  >30% in case of diffuse encephalopathy
- **Also in children: some with consistently "negative" EEG**
  - importance of non-epileptic phenomena
- **Also in children: some ictal recordings negative**
  - importance of video

The Sensitivity of a single EEG in epilepsy is relatively low (50-60%) but can be increased to more than 90% by repeated studies, notably sleep recordings.

The specificity of epileptiform discharges in the EEG is high (> 90%) in healthy awake subjects but decreases in cases of genetic traits and in subjects with other brain disorders but also in healthy subjects in case of lowered vigilance, drowsiness or sleep.

Reporting EEG

- Why ask for an EEG
- What to expect from the EEG
- What kind of EEG to request
- How to read the EEG
- How to report the EEG
- How to deal with the results of the EEG

Standard interictal EEG studies

- 30 minutes minimum
- Baseline eyes open / eyes closed
- 3 minutes hyperventilation
- Intermittent photic stimulation
- Sleep (60-90 minutes)
- 10-20% electrode system + inferior frontal/temporal
- Video especially in neonatal period : 5-8 (0-100) % seizures during standard studies
- **EEG Technician: indispensable eyes, ears and “extended arm” of the EEG-er**

…….. Once recorded (well) ….

What do we see ?????

What does it mean ?????

EEG studies for the diagnosis of epilepsy

- Of major importance for diagnosis & treatment
- Will usually help to decide on general management, in counseling, education etc.
- Must be interpreted by expert specialist
- Clinical interpretation needs “translation” to neurologist, pediatrician, general physician, patient, parent, teacher
- Choice of study (standard, monitoring, special tests):

Clinical Neurophysiologist !!!

- Clinical contex – present probability – is important
  - First seizure, normal kid, normal EEG ⟶ wait and see
  - First seizure, normal kid, abnormal EEG ⟶ likely wait and see; consider imaging
  - First seizure, abnormal kid, normal EEG ⟶ wait and see; consider imaging, further diagnostic evaluation
  - First seizure, abnormal kid, abnormal EEG ⟶ +/ – start AED (specific history + parental preference), image
  - Multiple seizures/events … different situation

Common fallacies concerning the EEG and the diagnosis of Epilepsy

"Positive" misconceptions

A positive finding of epileptiform activity in the EEG

indicates a diagnosis of epilepsy…

Thus…

Epileptiform Activity = Epilepsy = Epileptiform Activity

Common fallacies concerning the EEG and the diagnosis of Epilepsy

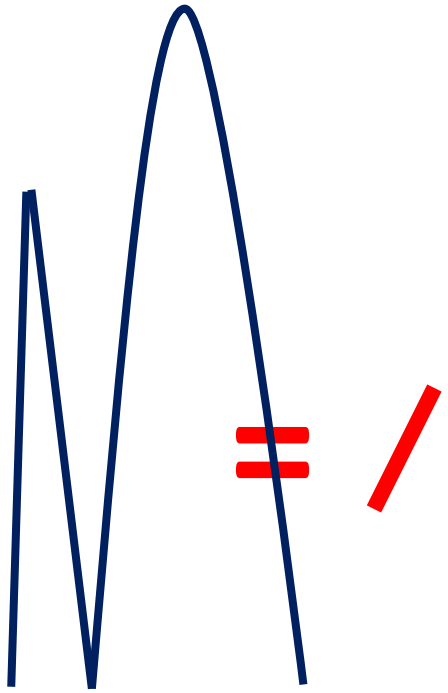
"Negative" misconception

Lack of finding of epileptiform activity in the EEG

excludes a diagnosis of epilepsy…

Thus…

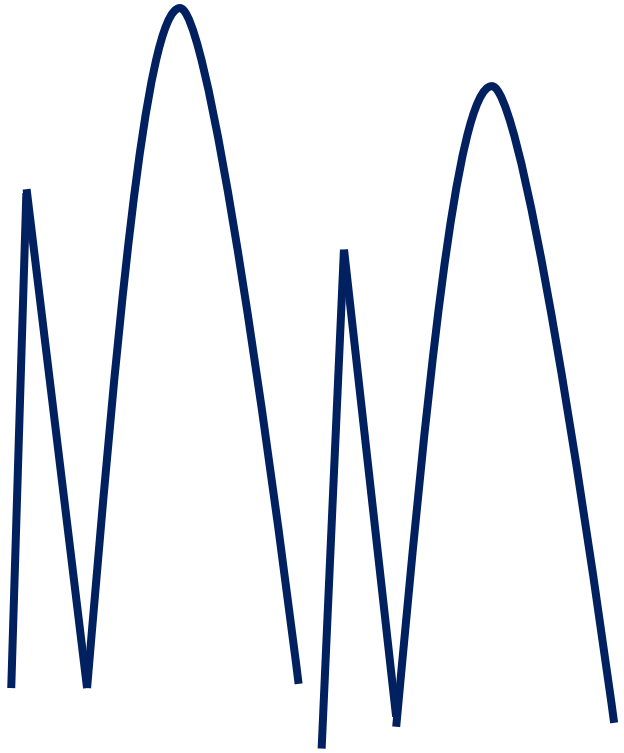
No Epileptiform Activity = No Epilepsy



= / Epilepsy

Epilepsy

is more than mere



- Nonetheless, despite advances in both EEG and neuroimaging, the history is still the mainstay for the diagnosis .