Epilepsy

Definition

- **Epilepsy** is defined as a repeated occurrence of unprovoked epileptic seizures or as one seizure and a high probability of further seizures

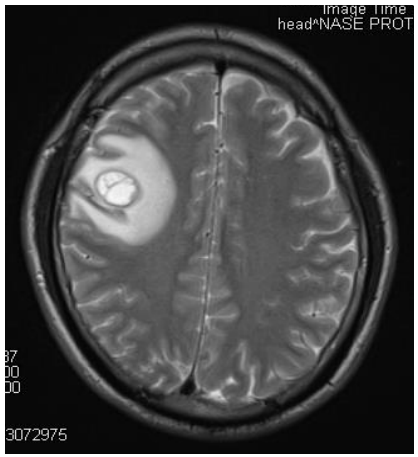
- **Epileptic seizure** = transient occurrence of motor, sensory, autonomic, or psychic symptoms or changes of behaviour due to abnormal excessive or synchronous neuronal activity in the brain

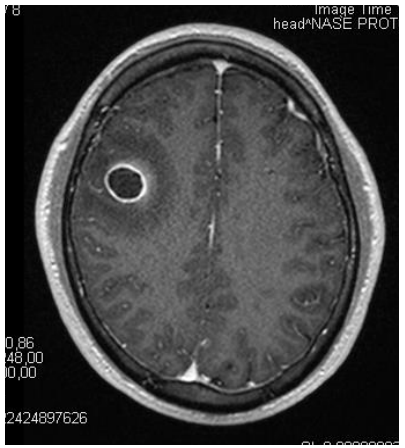
Definition

- Epilepsy is not a single disease entity, but a wide range of different diseases that have multitude of different manifestations, causes and variable prognosis, and with the occurrence of epileptic seizures being their common feature.

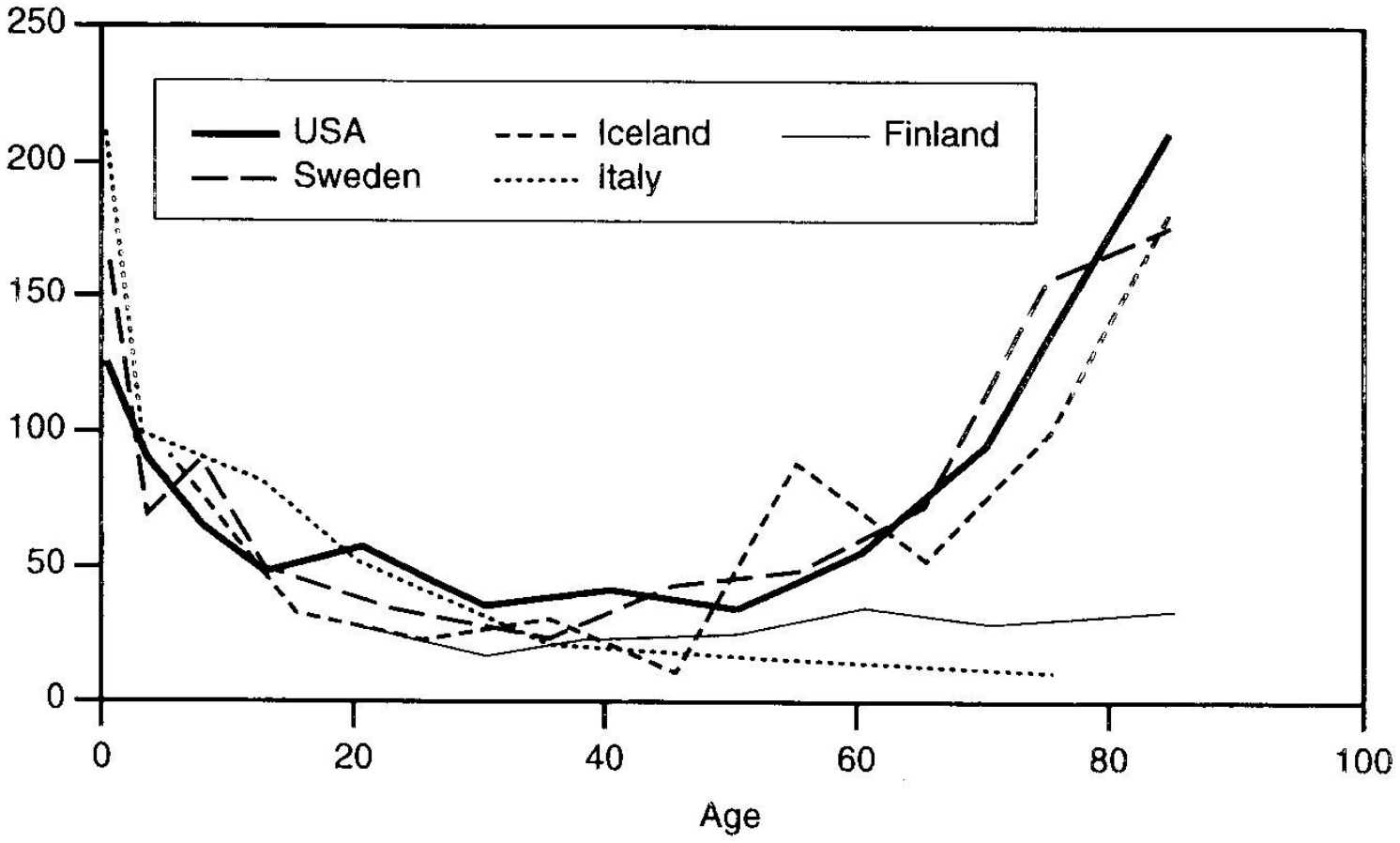
Prevalence

- Epilepsy affects about 1% of adult population
- About 10% of general population have at least one seizure in their lifetime
- Prevalence in developing countries is higher due to higher rate of neuroinfections, parasitic diseases, brain trauma





U-shaped dependency on age



Diagnosis

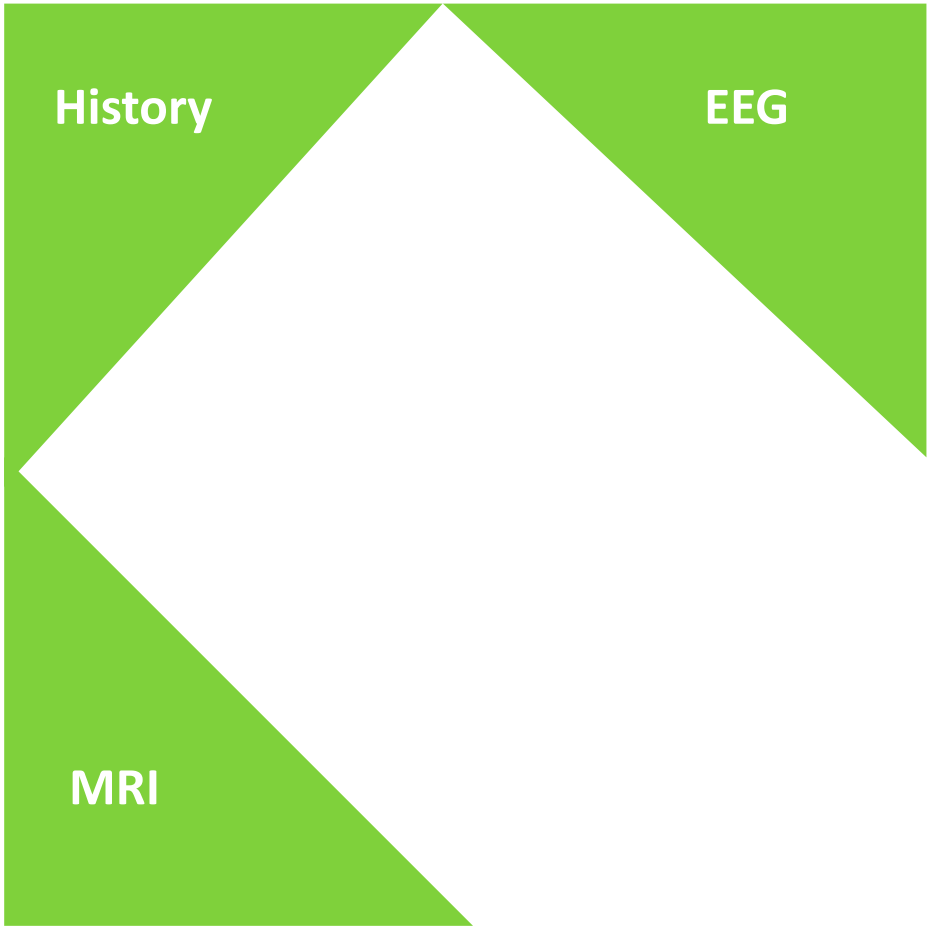
- Positive proof is always required.
- The diagnosis has many medical and non-medical consequences
- Usual diagnostic pitfalls: Syncope and psychogenic non-epileptic seizures (PNES)

Diagnostic tools

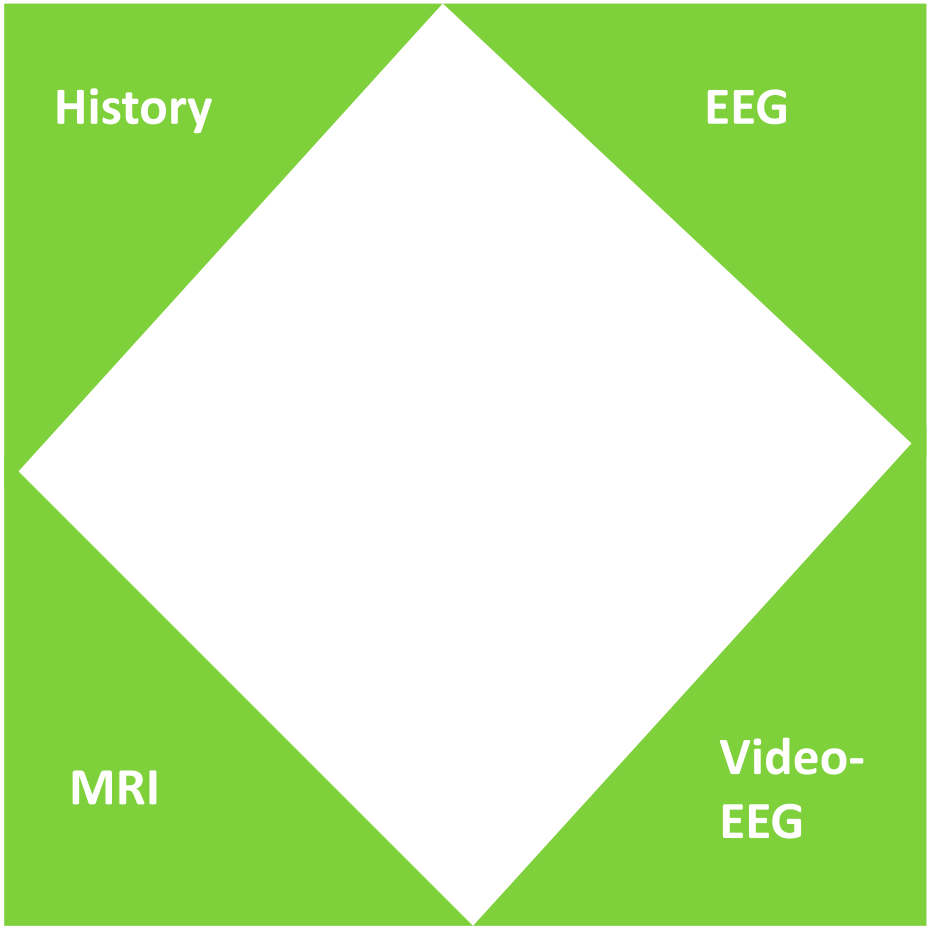
History

Diagnostic tools

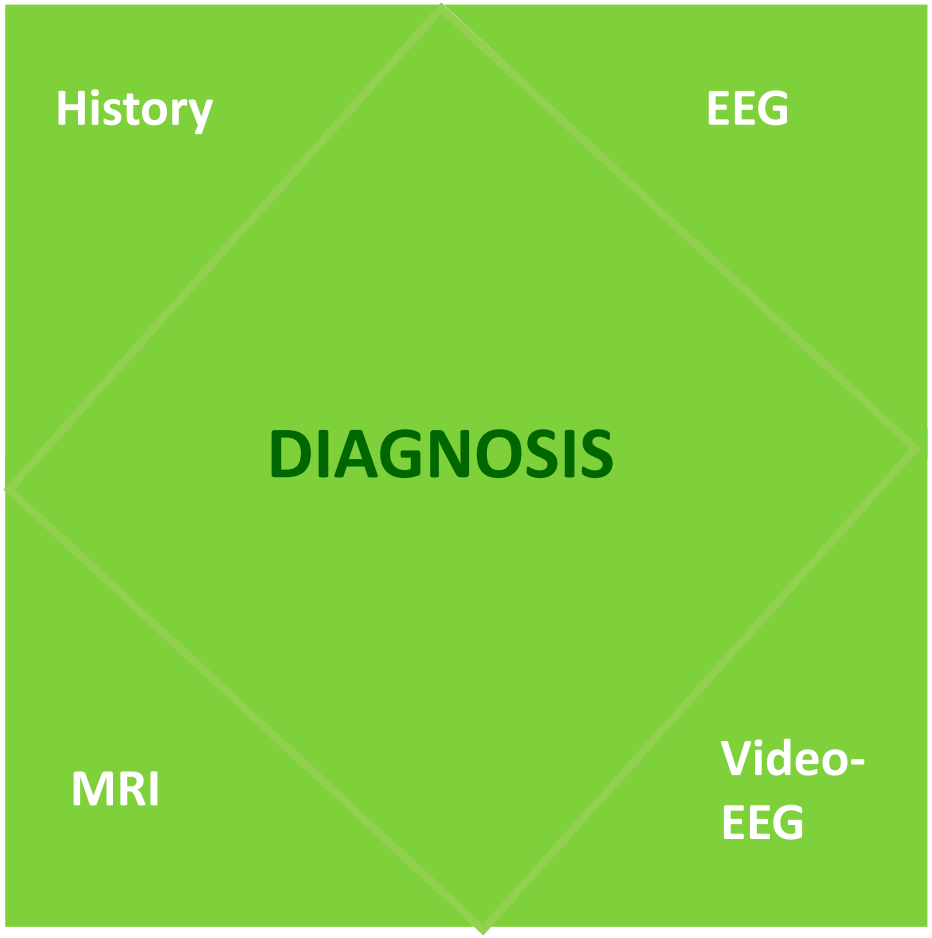
Diagnostic tools



Diagnostic tools



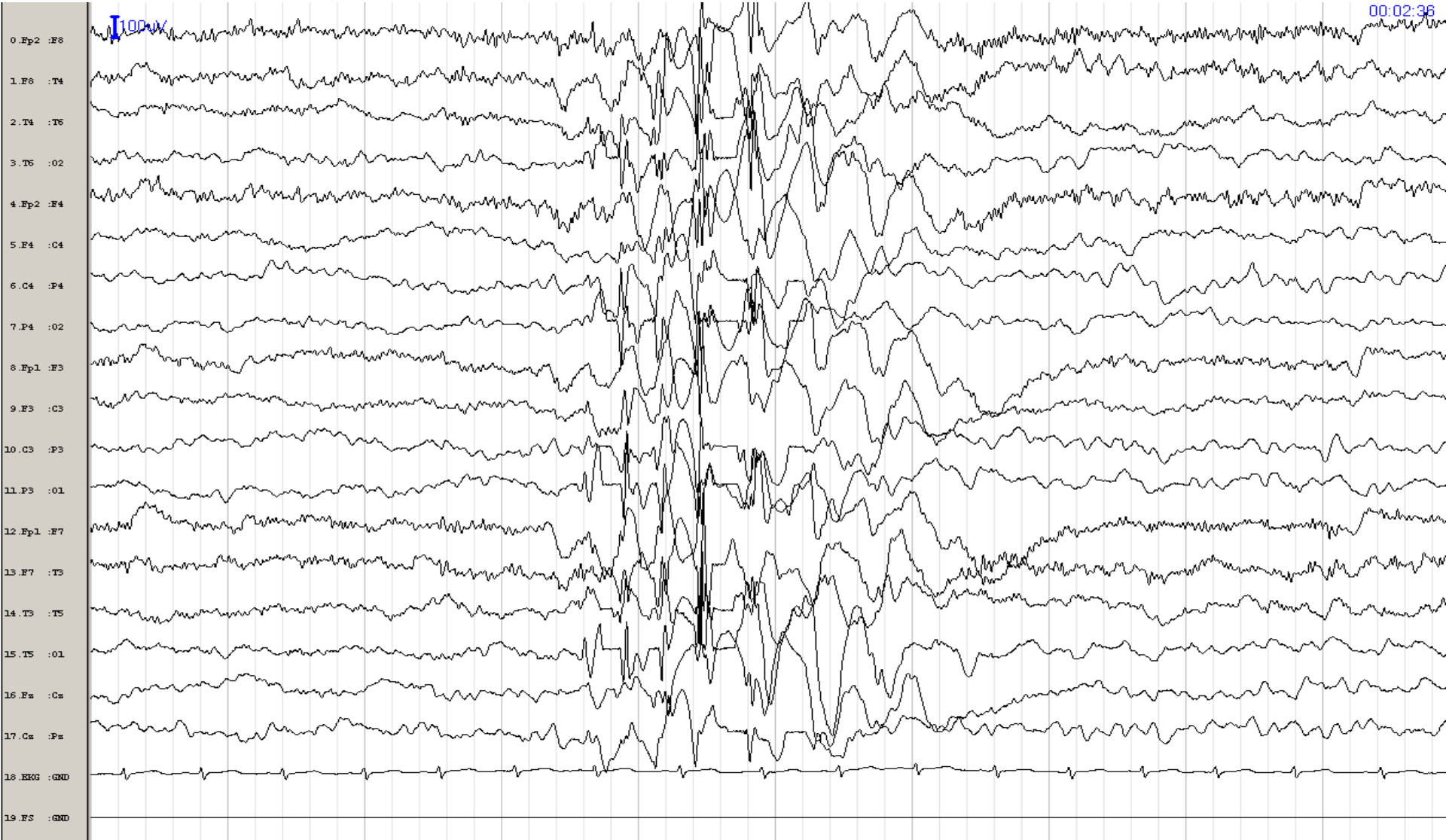
Diagnostic tools



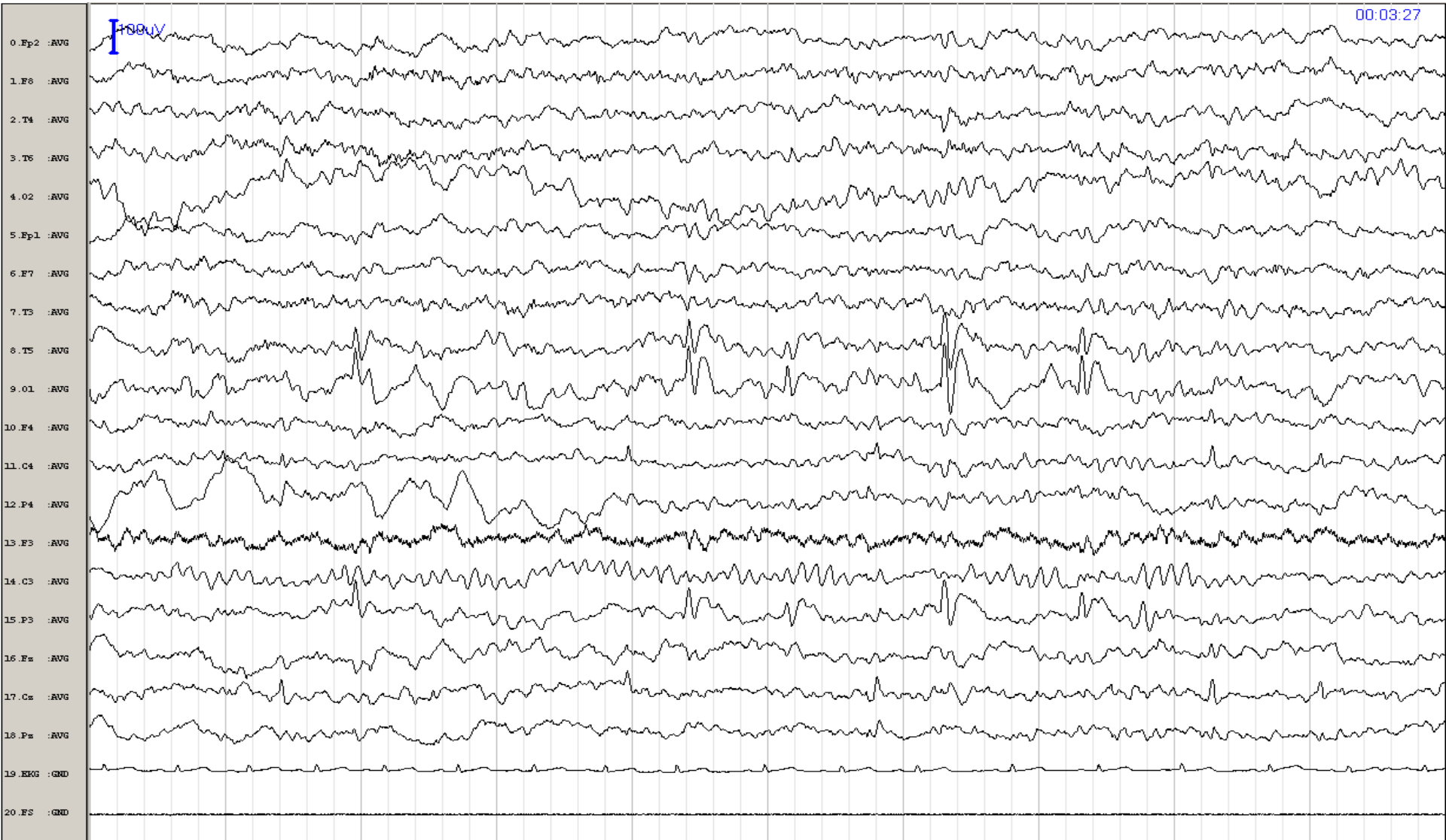
EEG

- Epileptiform discharges: spike, sharp wave
- Frequently in complexes with slow wave
- Generalized or focal
- Interictal = between seizures or ictal = during seizures
- Interictal EEG frequently normal in epilepsy patients

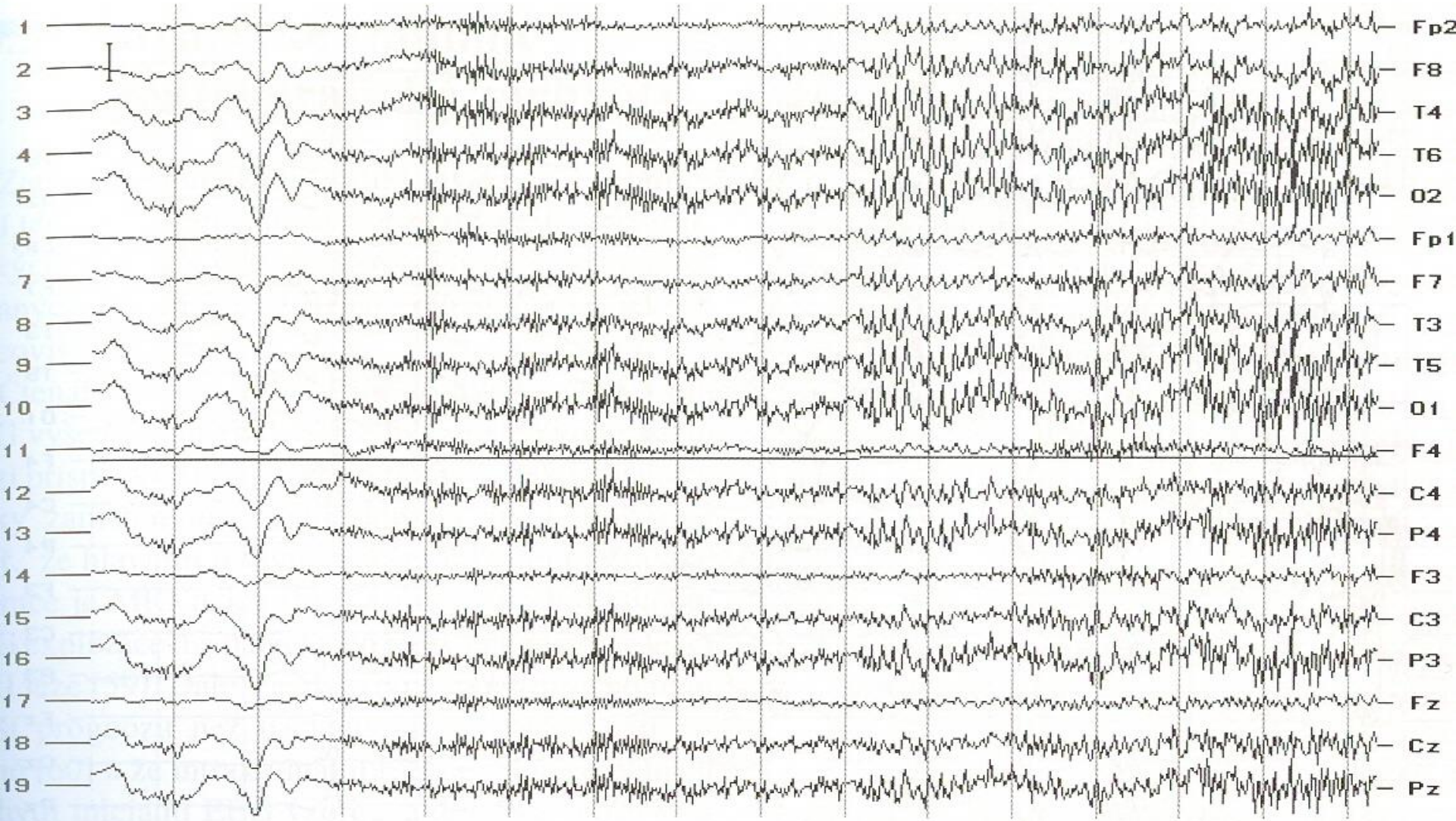
EEG: interictal generalized discharges



EEG: interictal focal discharges



EEG: ictal recording of tonic-clonic seizure



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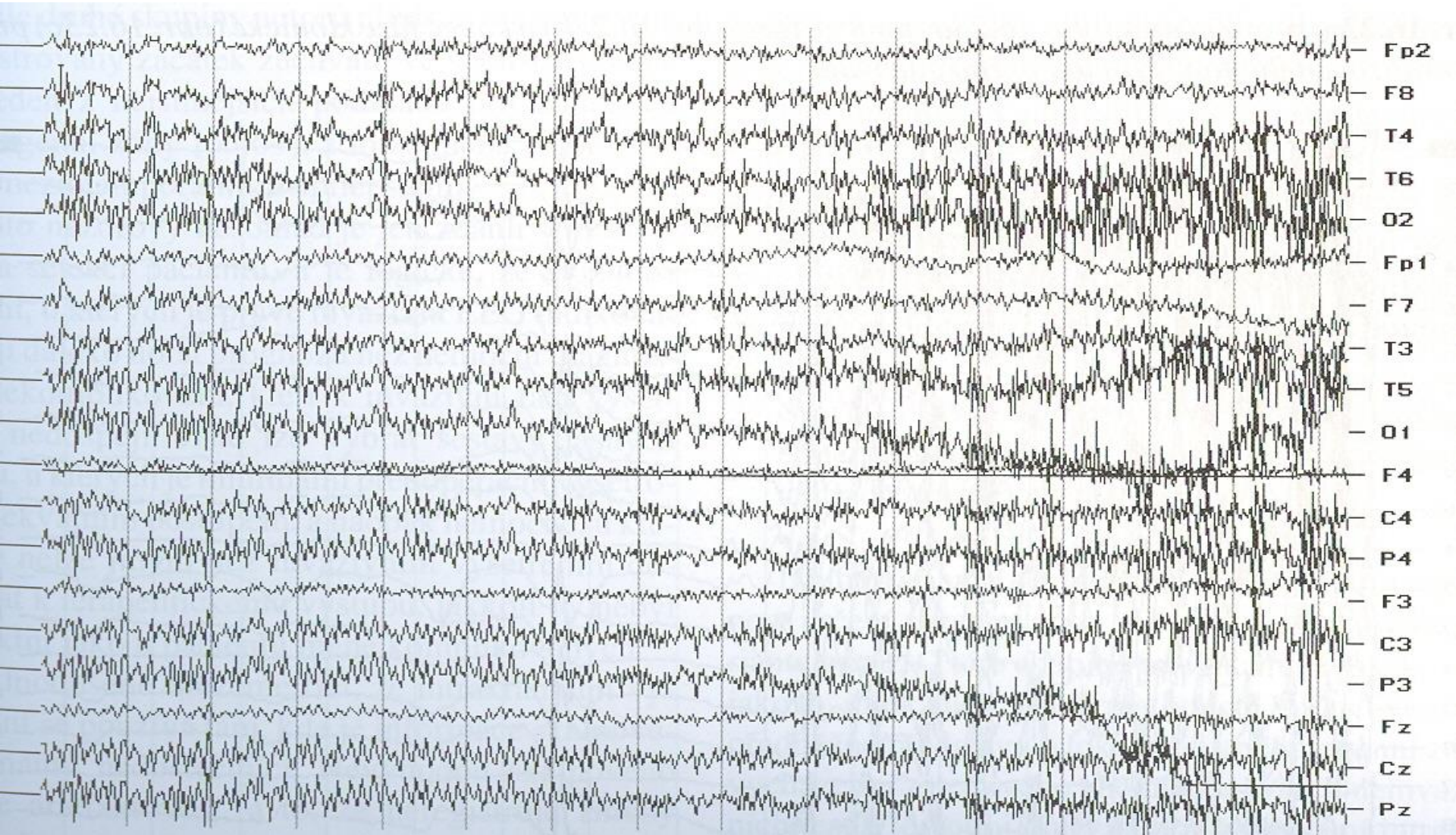

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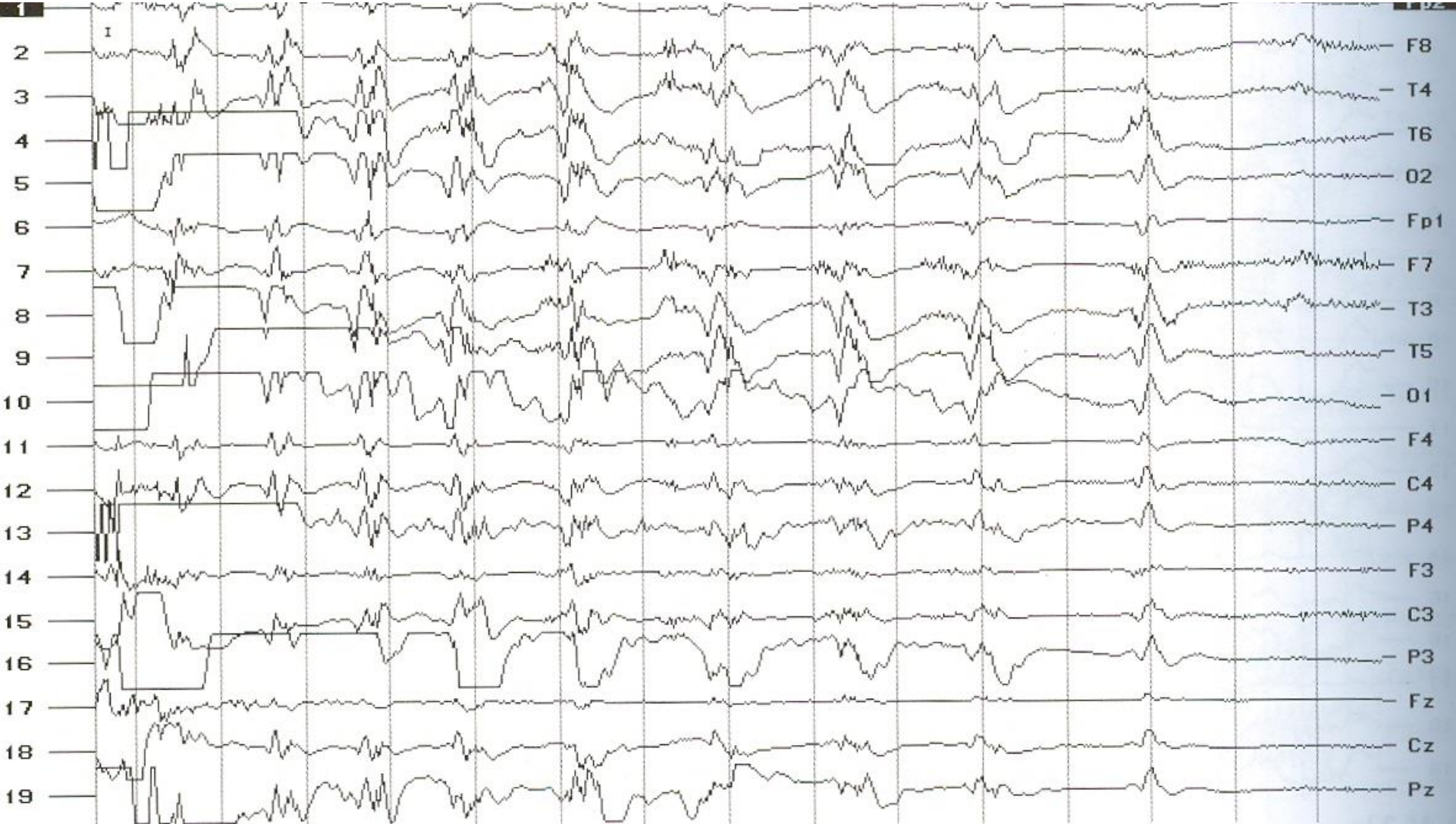
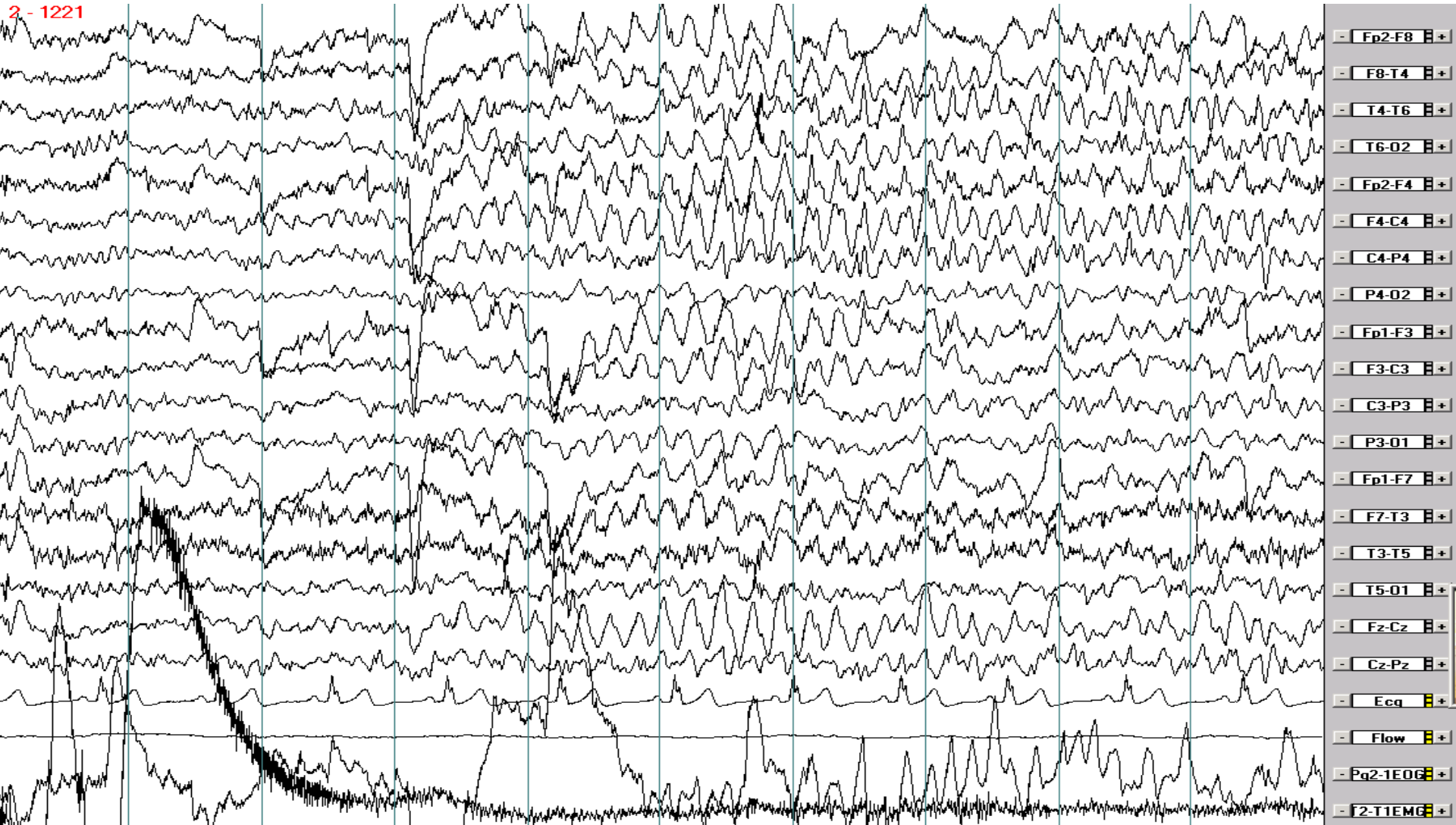


EEG: ictal recording of focal seizure



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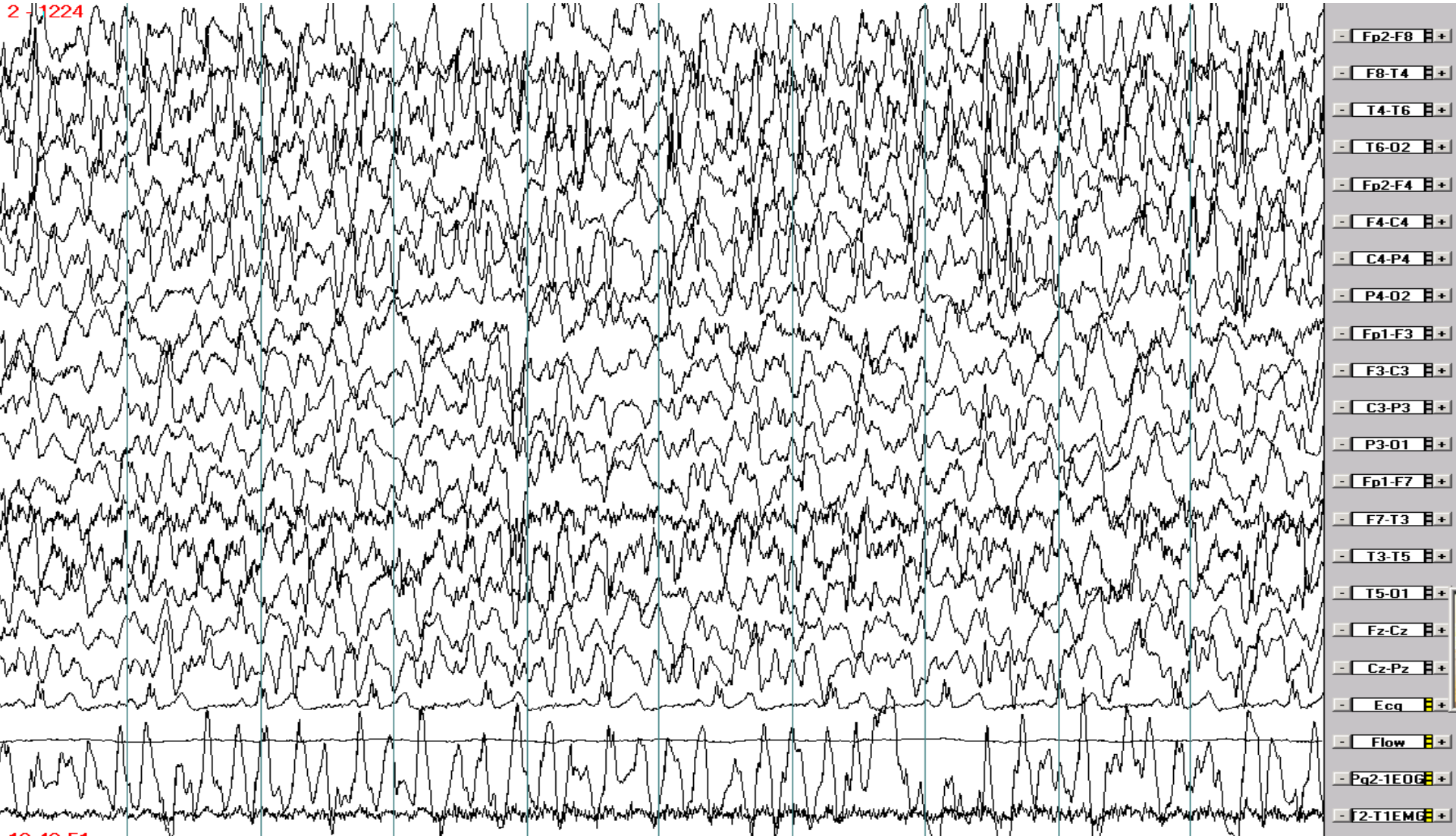

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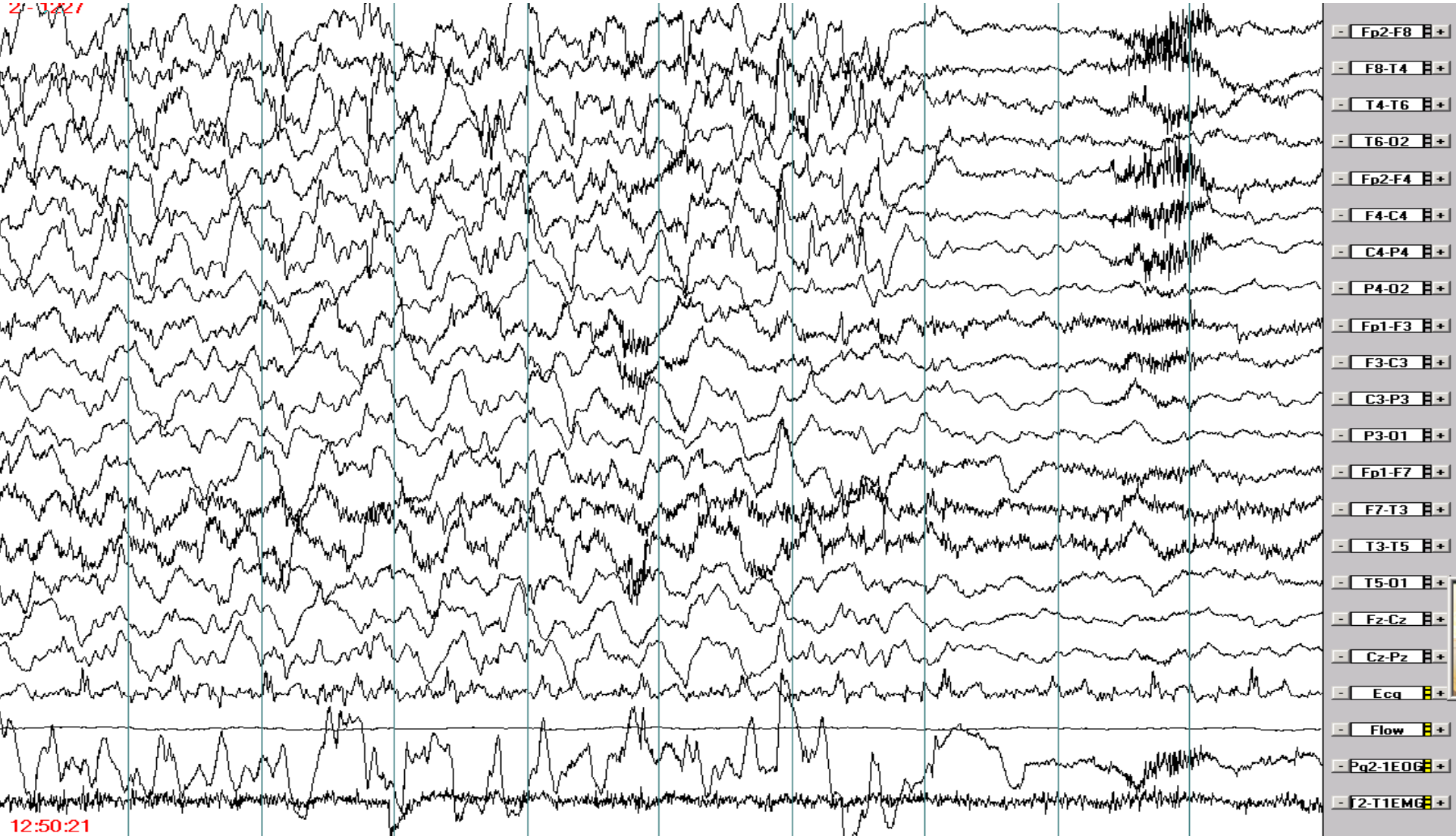


Classification of seizures

Focal onset

Generalized onset

Unknown onset

Aware

Impaired Awareness

Motor onset

Nonmotor onset

Sensory, cognitive, emotional, autonomic, behavior arrest

Motor

Tonic-clonic, myoclonic, atonic

Nonmotor (Absence)

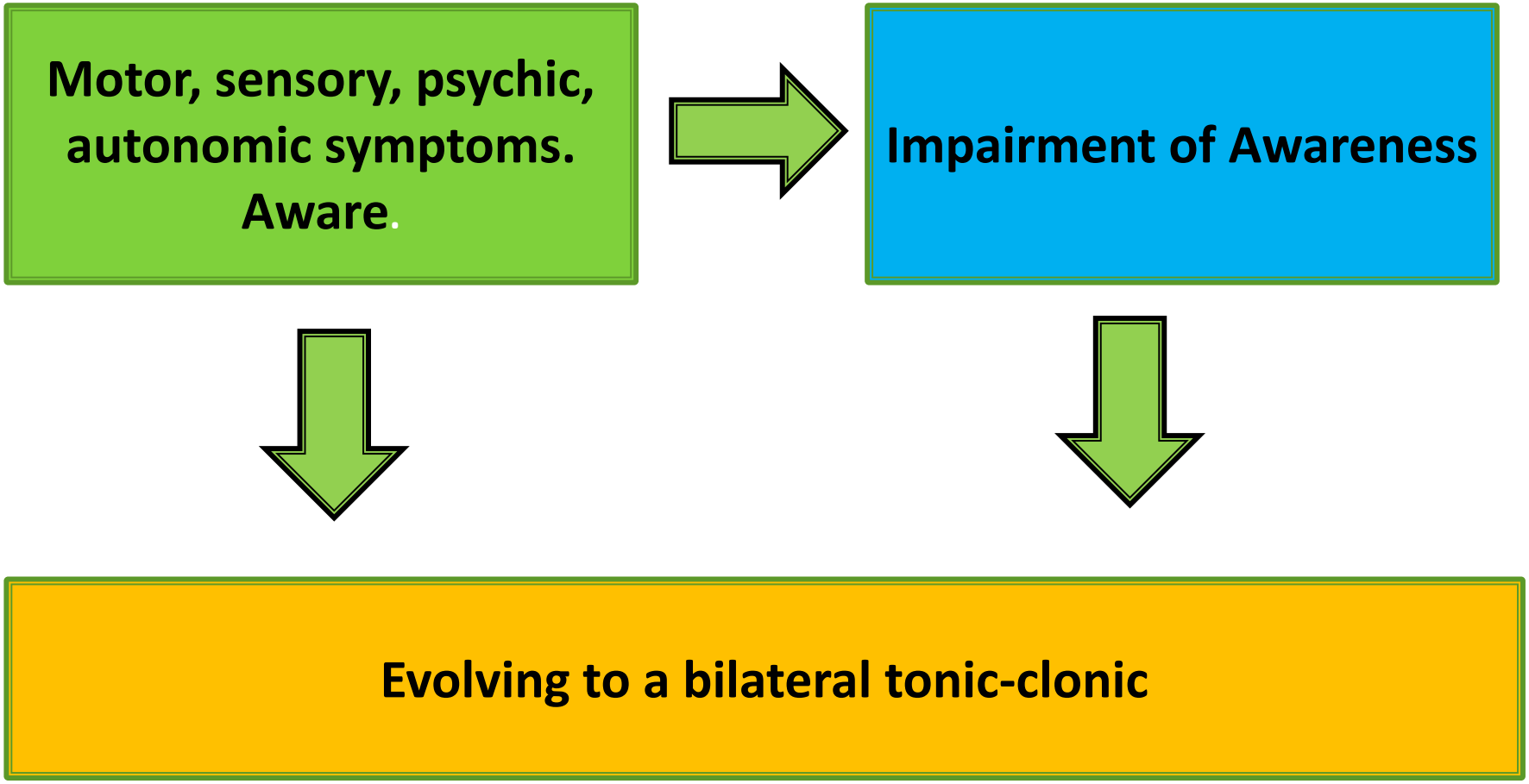
Motor

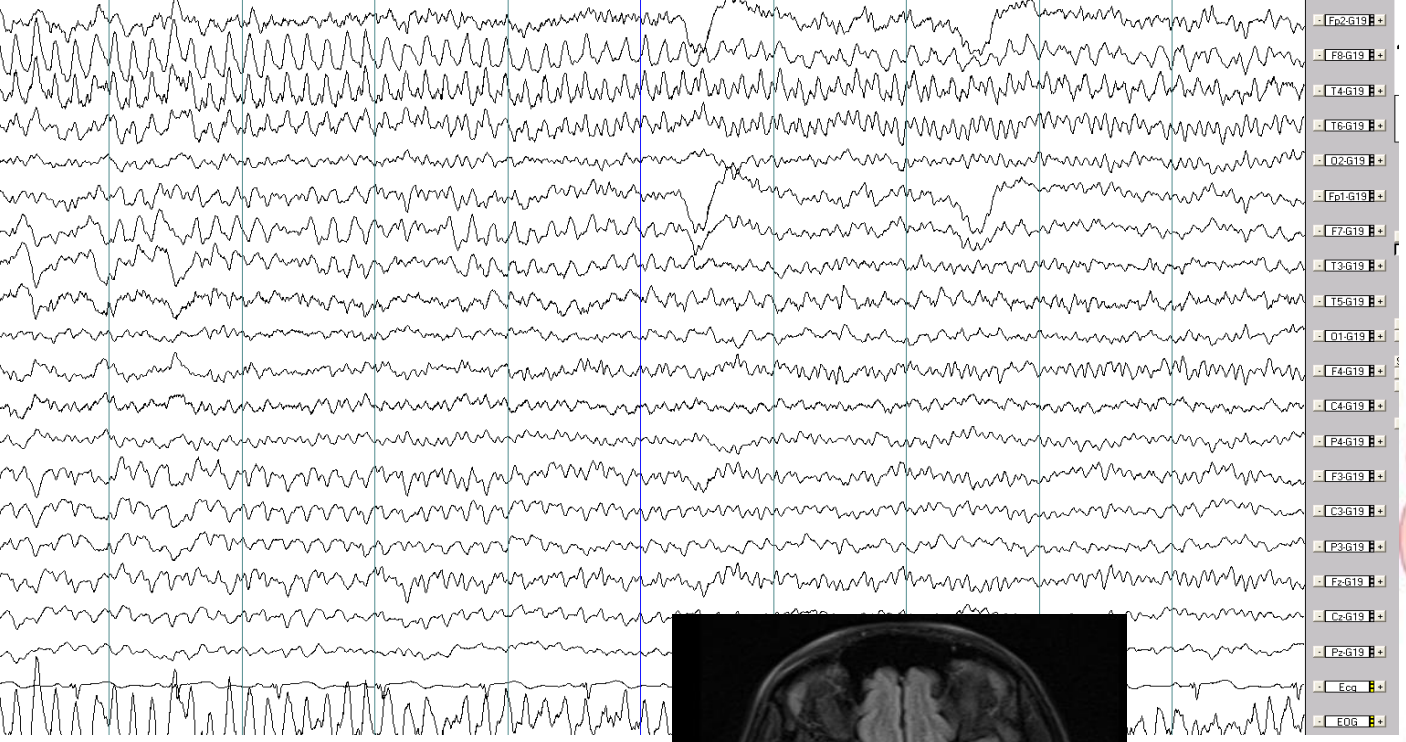
Nonmotor

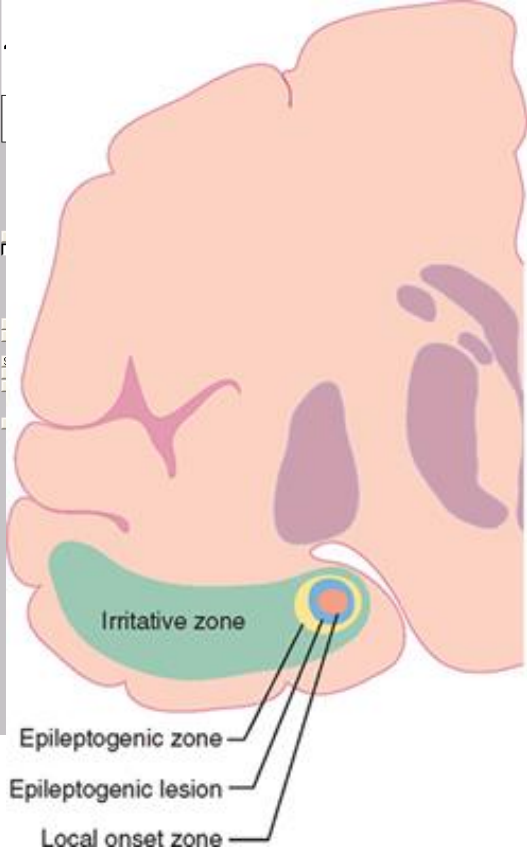
Focal to bilateral tonic-clonic

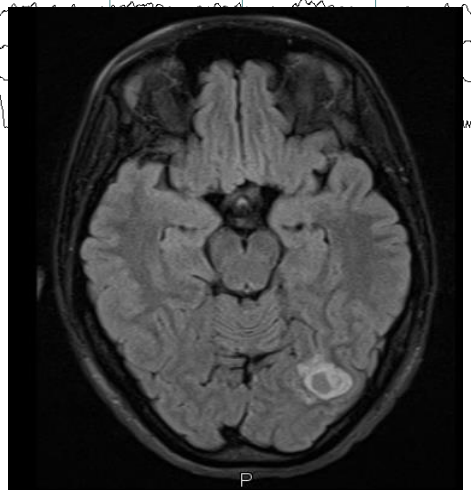
Unclassified

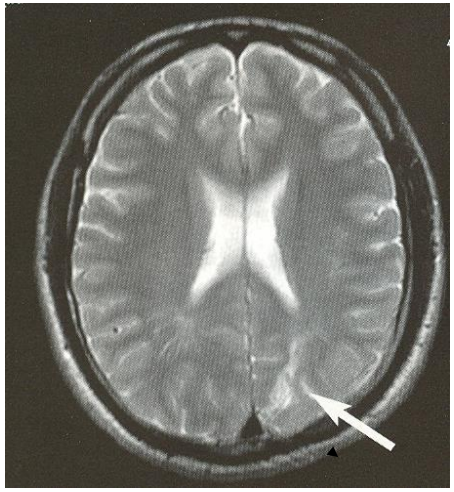
Seizures with focal onset

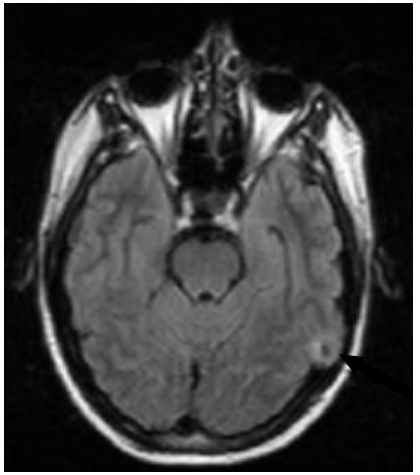




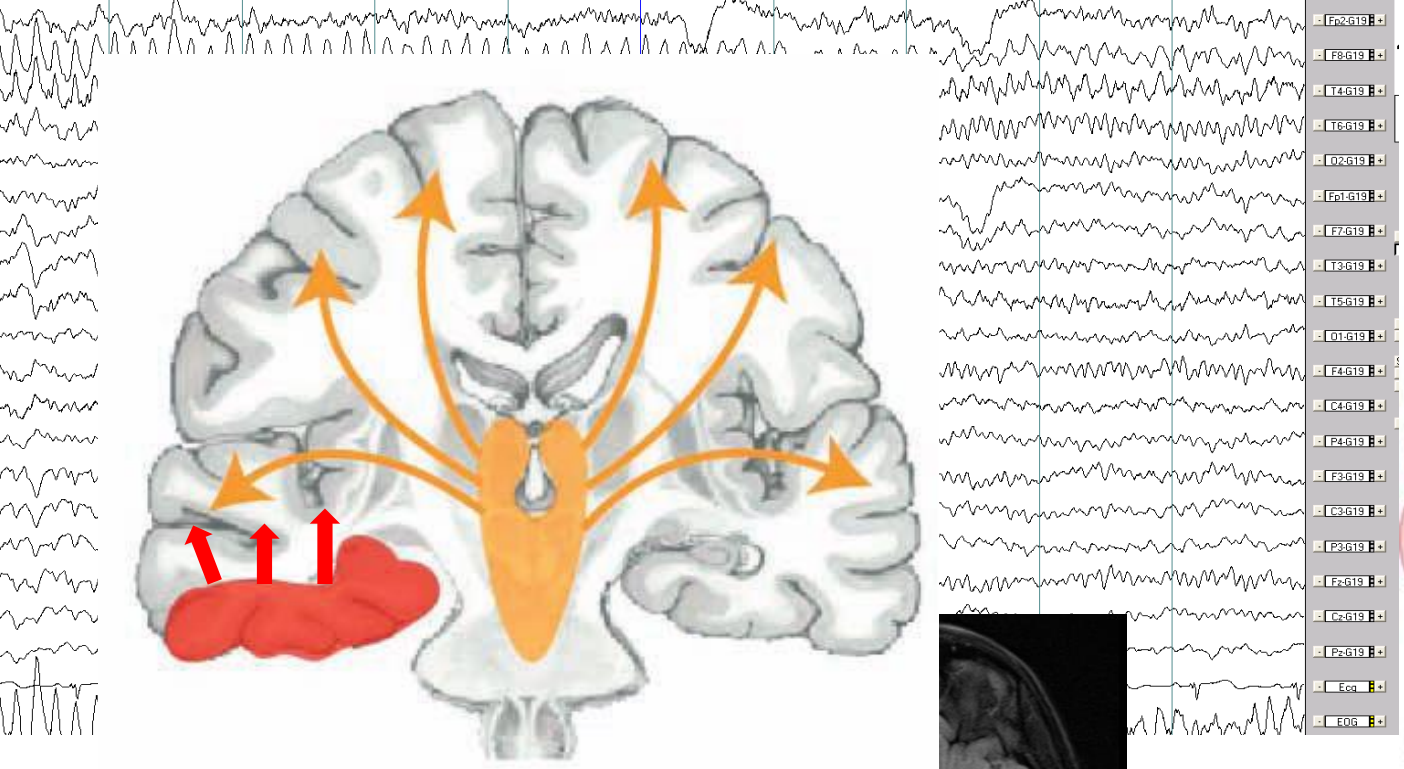


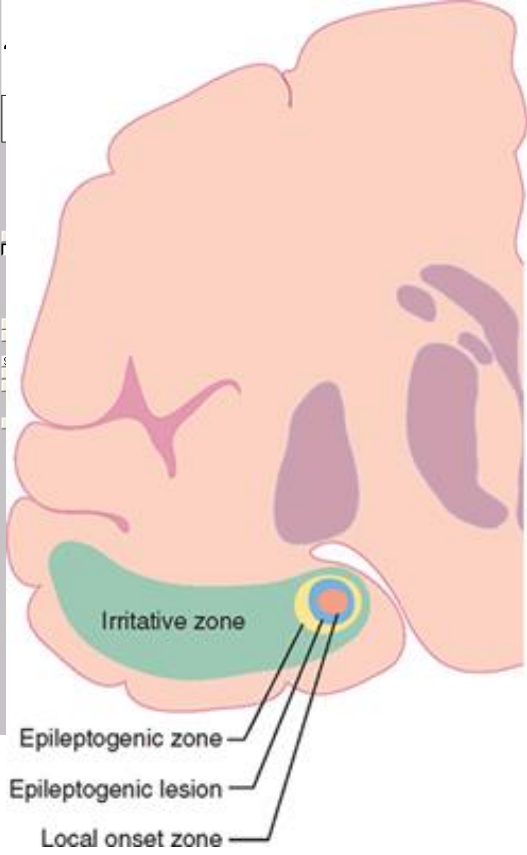


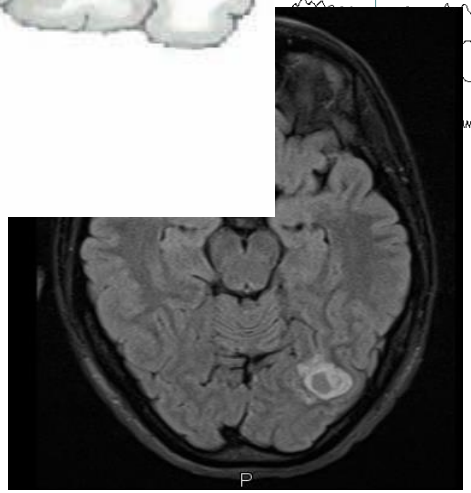


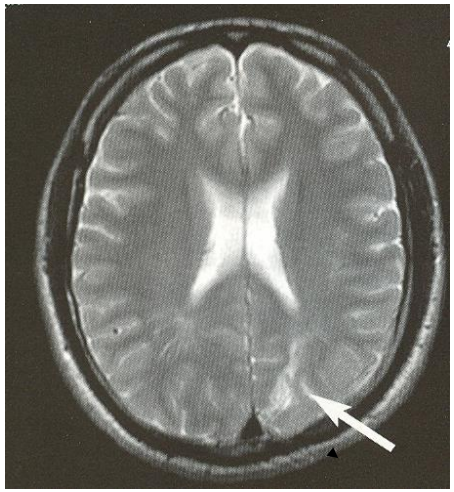


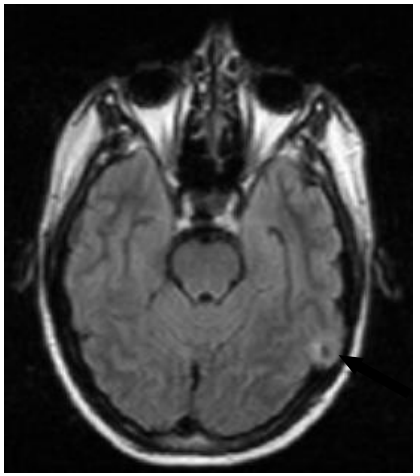
Focal epilepsies











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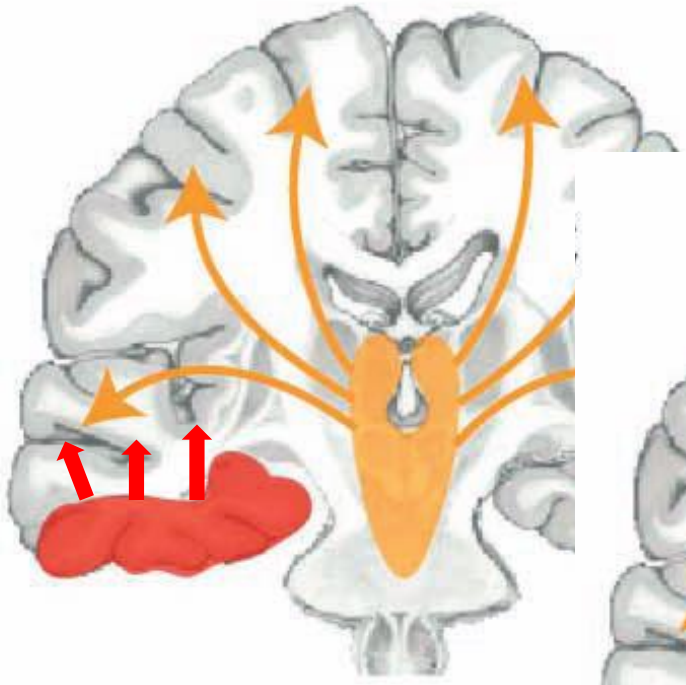
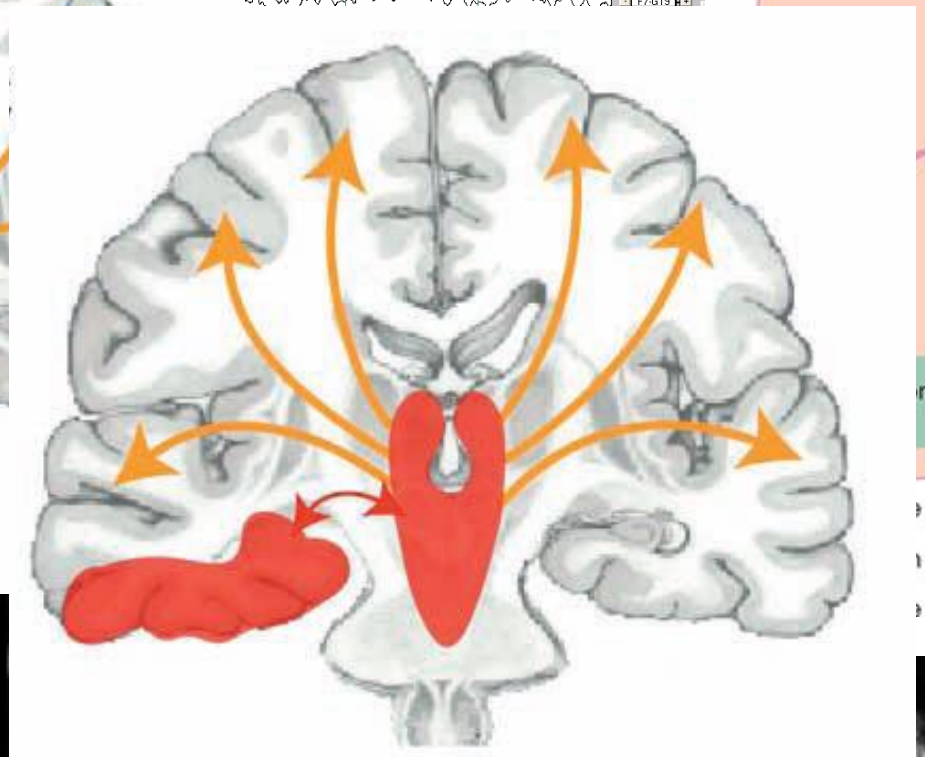
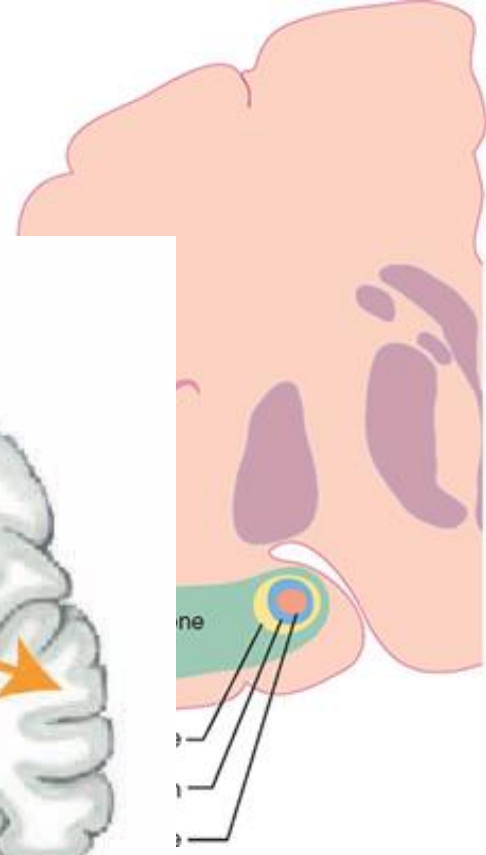
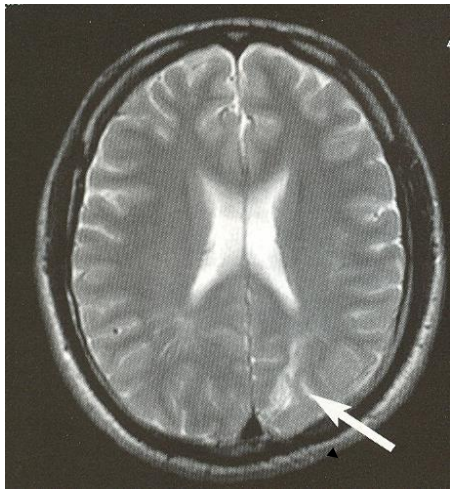
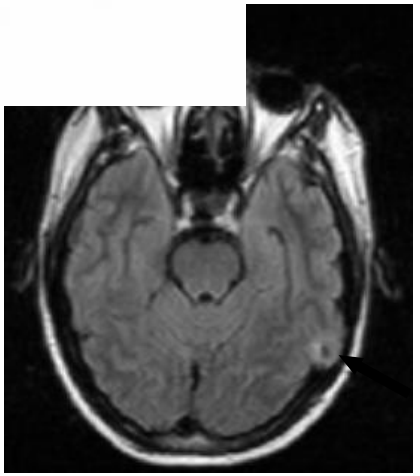




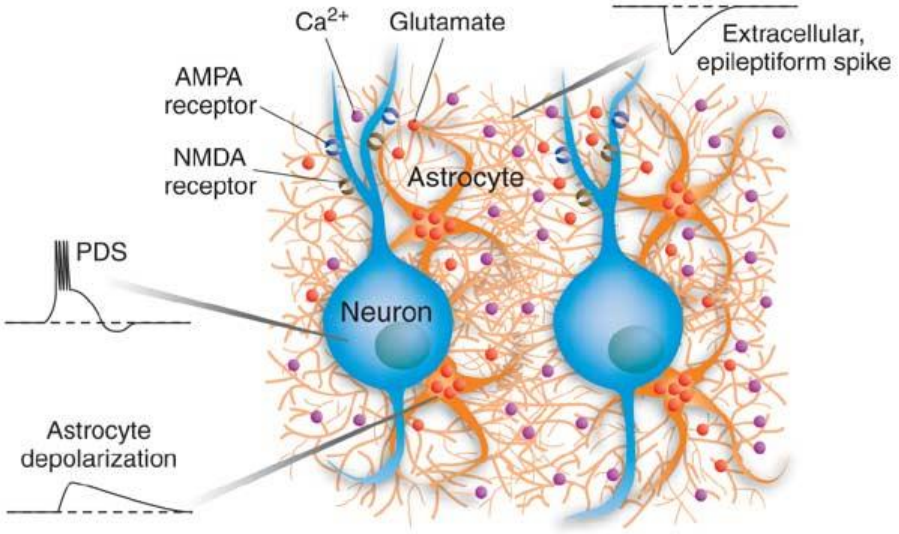


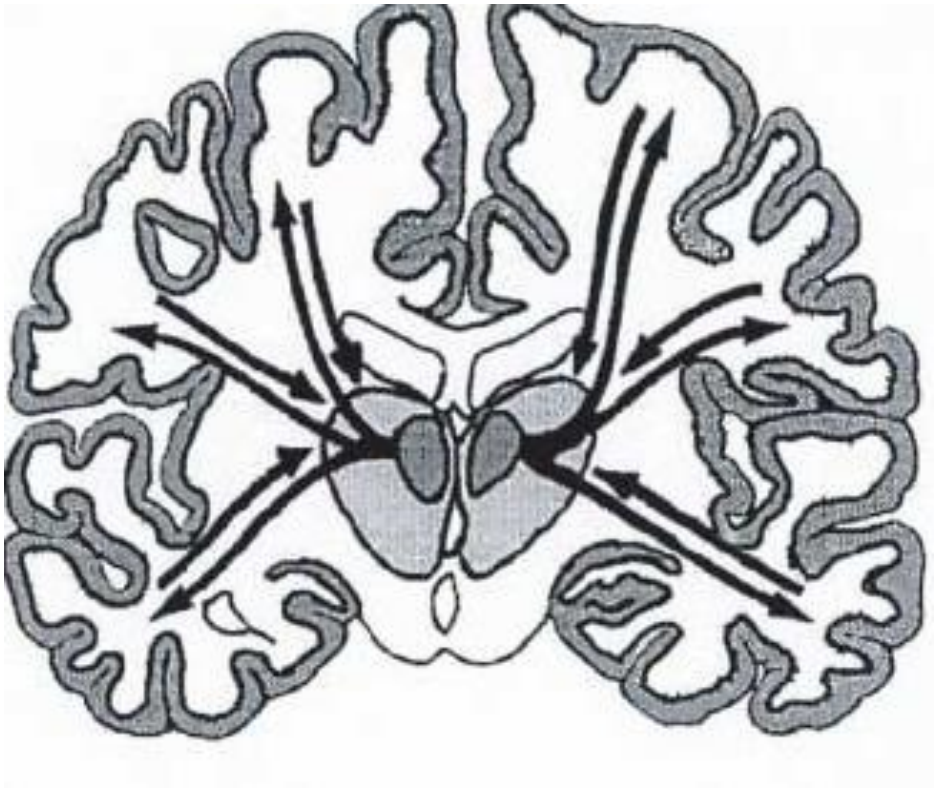


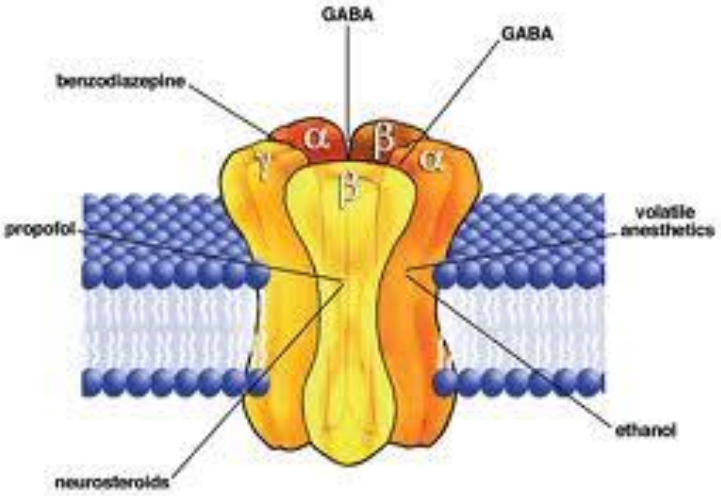


Focal epilepsies

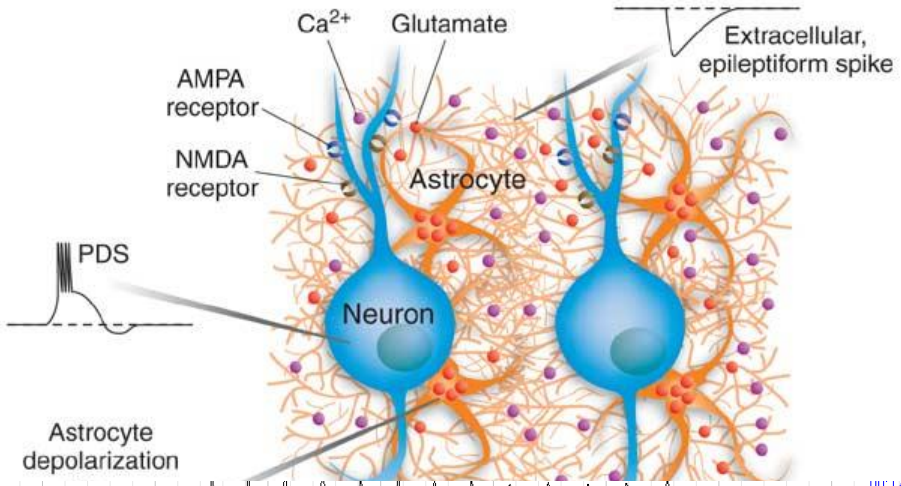
Generalized epilepsies

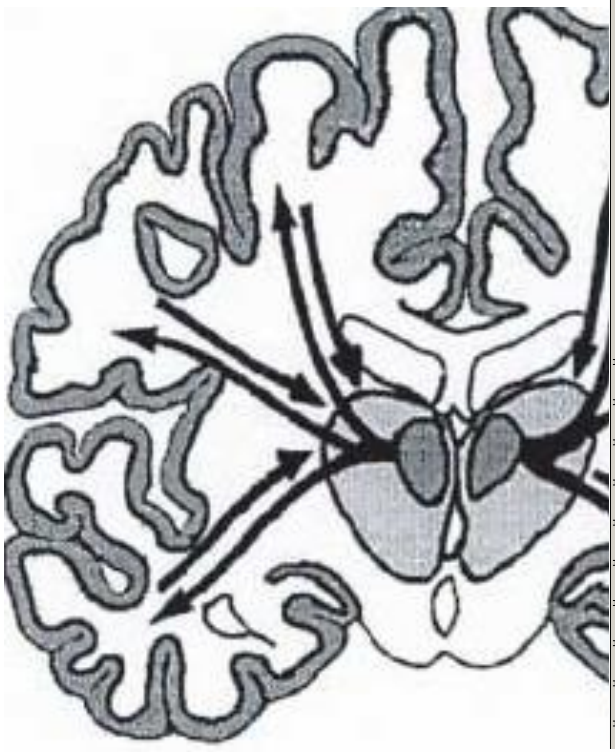


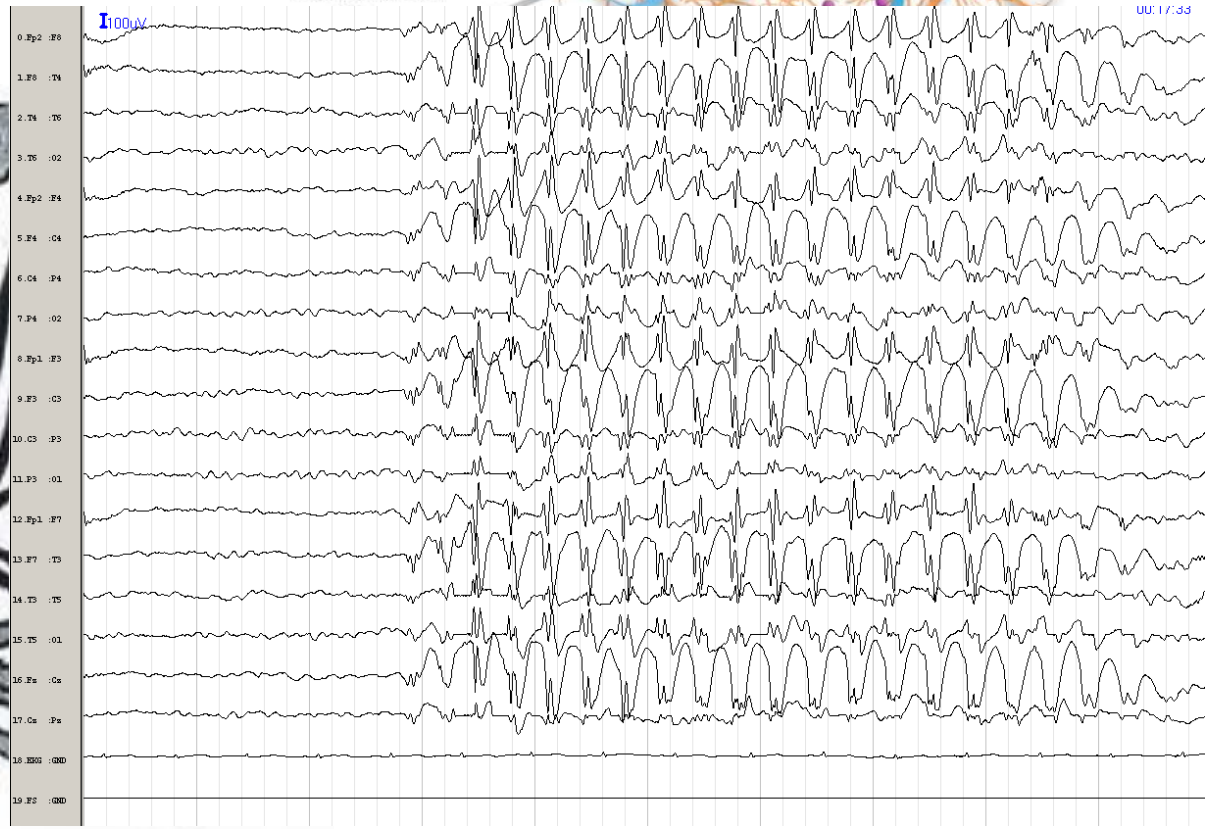




Generalized epilepsies







Absences

- Short loss of awareness with few or no other symptoms
- Abrupt onset and termination
- Patients are usually not aware that they are having a seizure
- Typically age related
- EEG always positive
- Good response to treatment

Myoclonic seizures

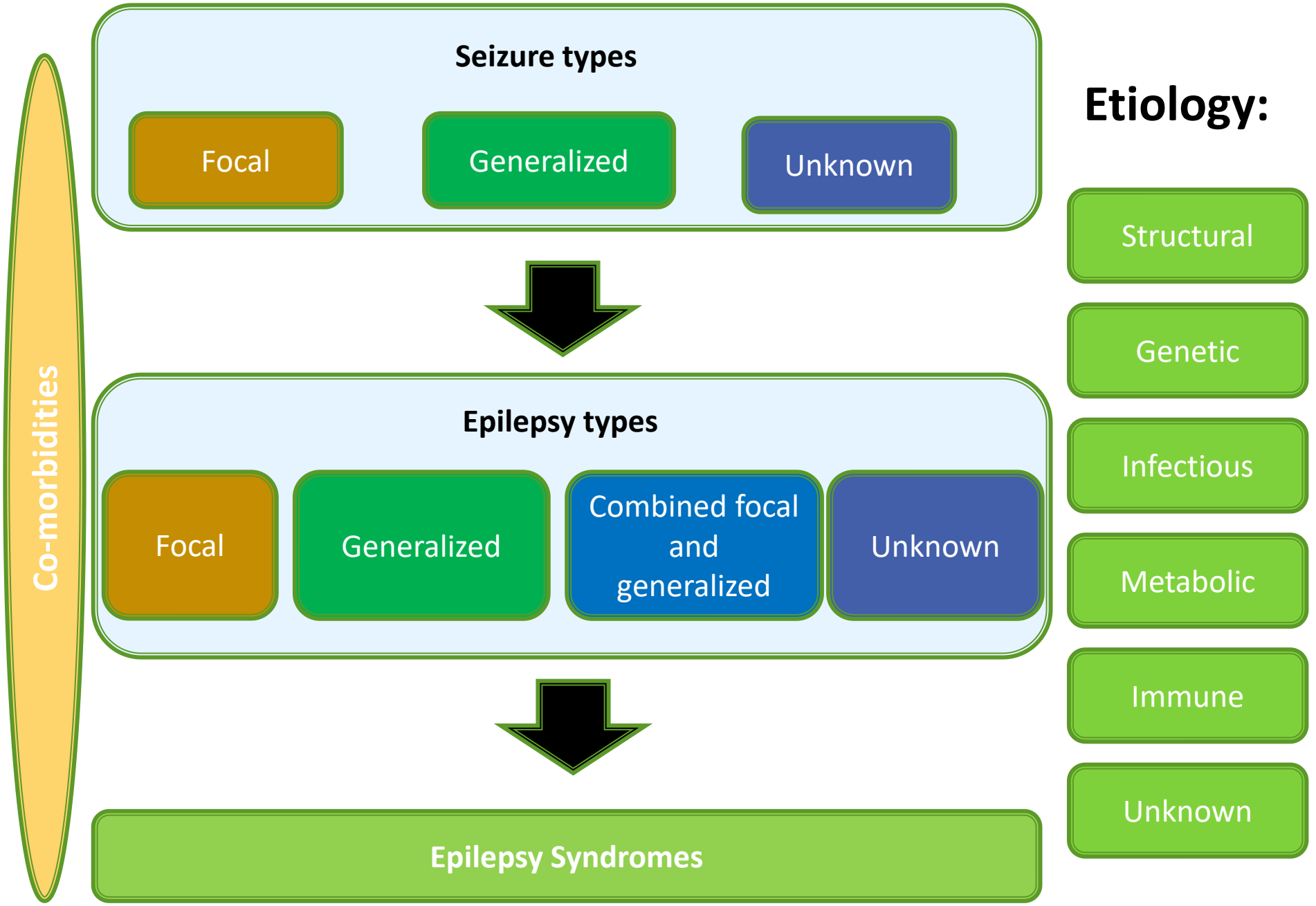
- Sporadic jerks, usually on both sides of the body
- When violent, these seizures may result in dropping or involuntarily throwing objects
- Awareness is not impaired

Tonic-clonic seizure

- Starts with loss of consciousness and sudden tonic contraction of muscles which causes the person to fall
- Some people may cry out at the beginning of the seizure
- Cyanosis
- After 10-20 seconds the convulsions go into clonic phase - rhythmic contractions of muscles, tongue biting or loss of bladder or bowel control may occur
- Convulsions involve the entire body including face, eyes open
- Slow recovery of consciousness through confusion and drowsiness, the person may have headache and muscle aches for the next 24 hours.

Etiology

- Genetic
- Metabolic
- Structural
  - tumour
  - trauma, birth trauma
  - vascular malformation
  - brain infarct, haemorrhage
  - malformation of cortical development (cortical dysplasia)
- Infectious
- Immune
- Unknown cause – probably genetic cause (idiopathic) or undetectable structural lesion


Seizure types
Focal
Generalized
Unknown
Epilepsy types
Focal
Generalized
Combined focal and generalized
Unknown
Epilepsy Syndromes
Co-morbidities
Etiology:
Structural
Genetic
Infectious
Metabolic
Immune
Unknown

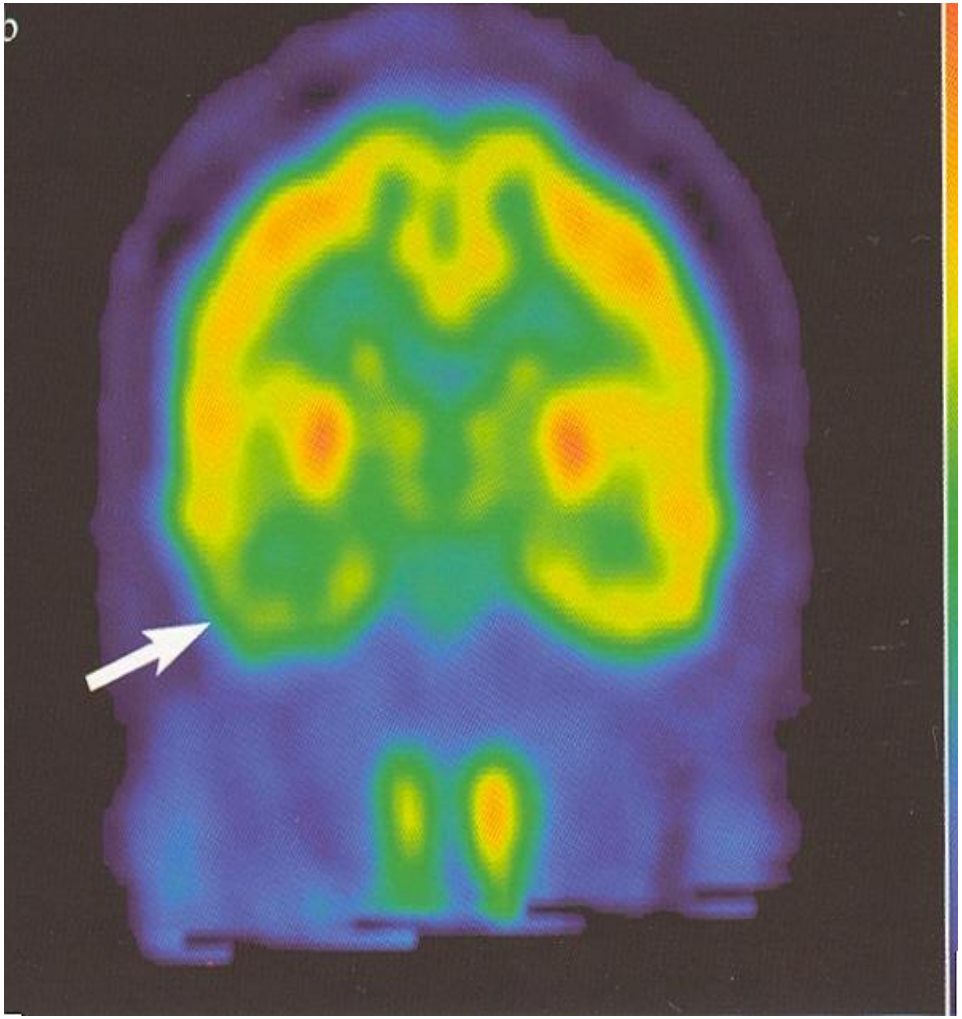
Juvenile myoclonic epilepsy

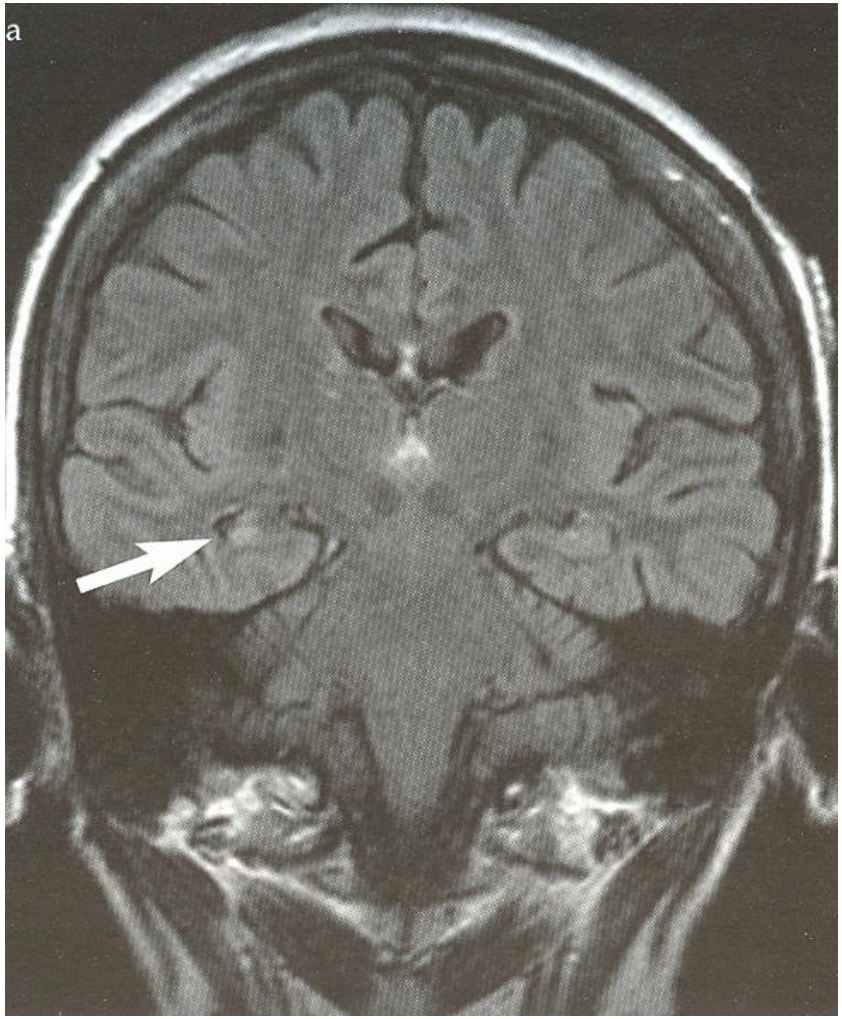
- Absences (in 30%) – onset at the age of 5-16 years, myoclonic seizures at 14-15 years, tonic-clonic seizures a few months later
- Most seizures occur on awakening
- Precipitated by sleep deprivation, excessive alcohol intake, photosensitivity in 30%
- Good response to treatment, but lifelong treatment is necessary, high risk of relapse

Mesial temporal lobe epilepsy with mesiotemporal sclerosis

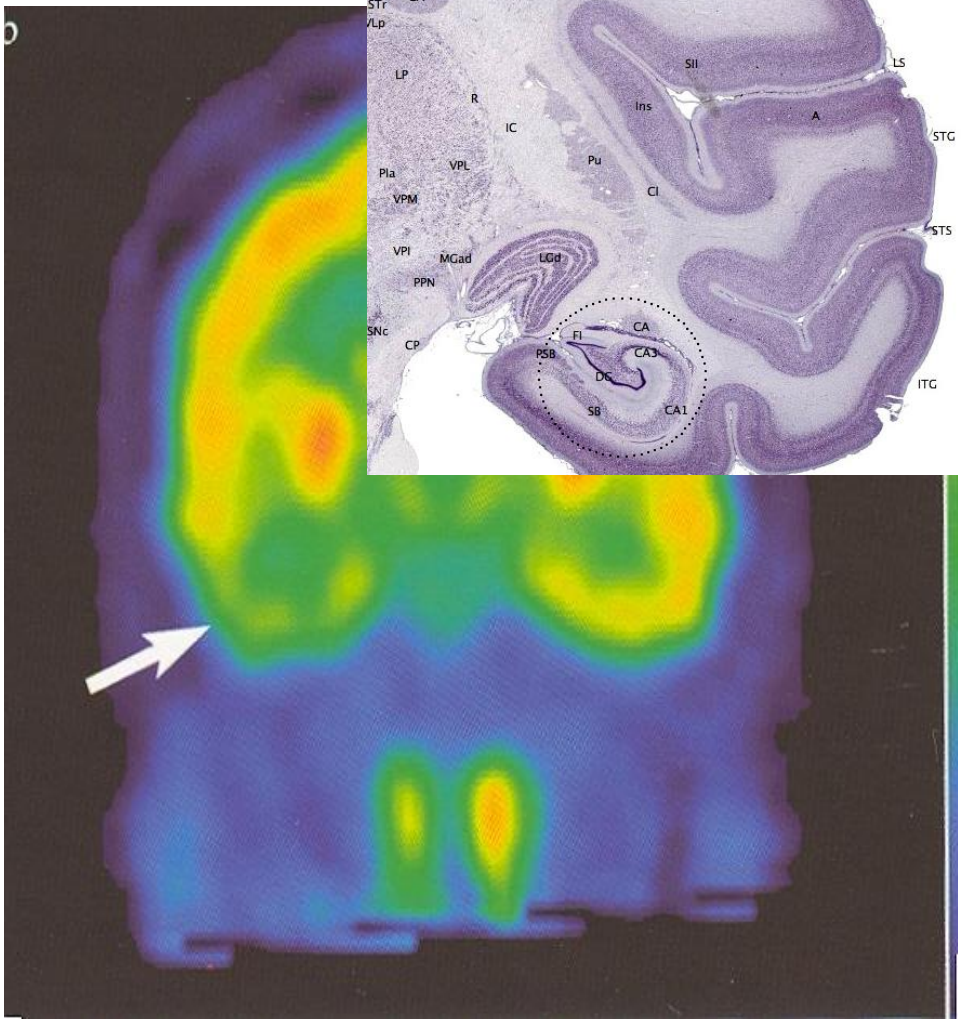
- Prolonged febrile convulsions or other cerebral insult in early life
- Onset of focal seizures at the age of 4-16 years, frequently farmacoresistant.
- Neurosurgical treatment

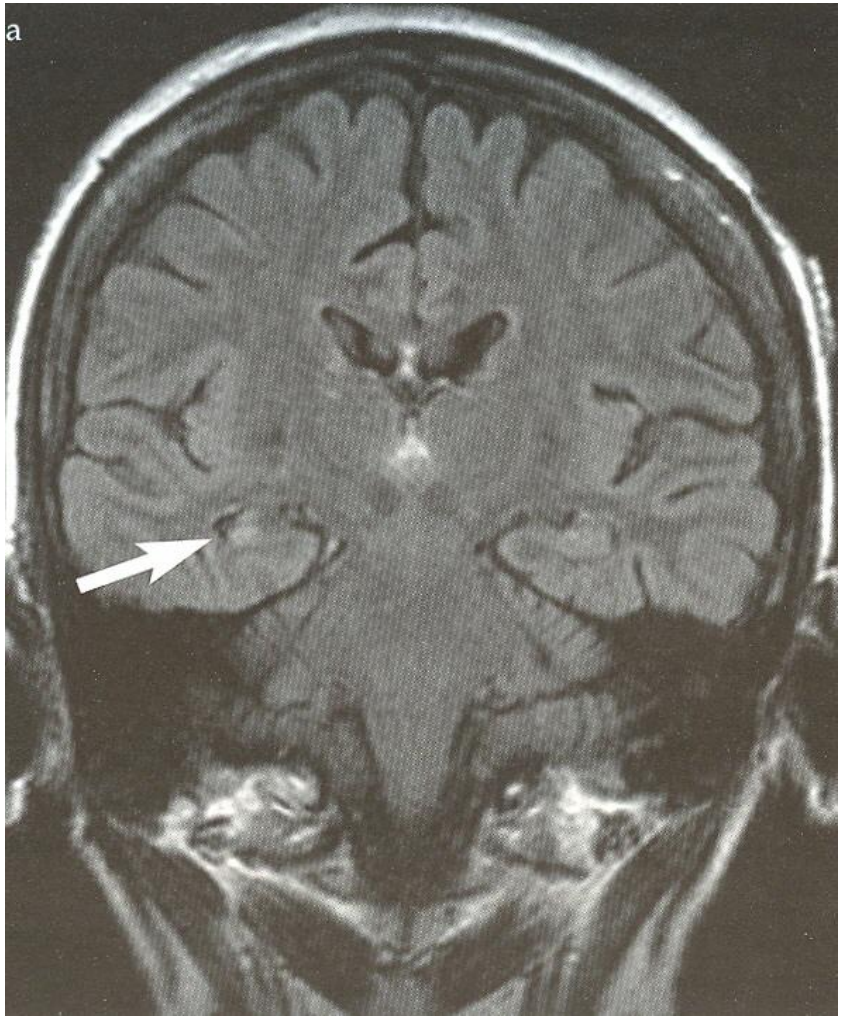
Mesiotemporal sclerosis





Mesiotemporal sclerosis





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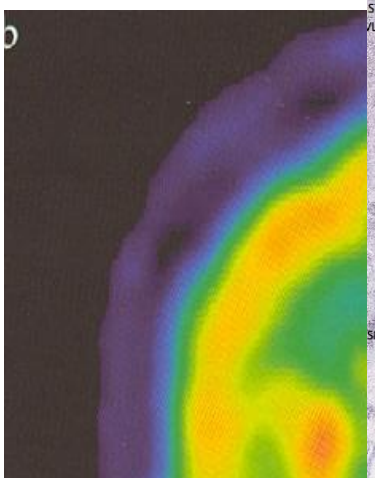
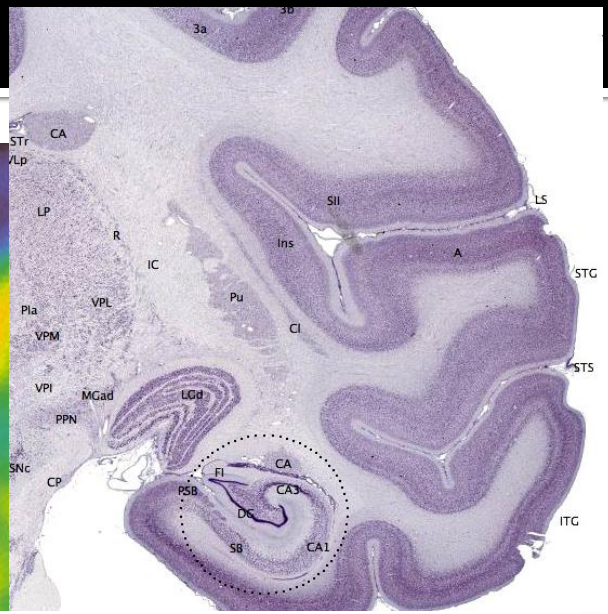
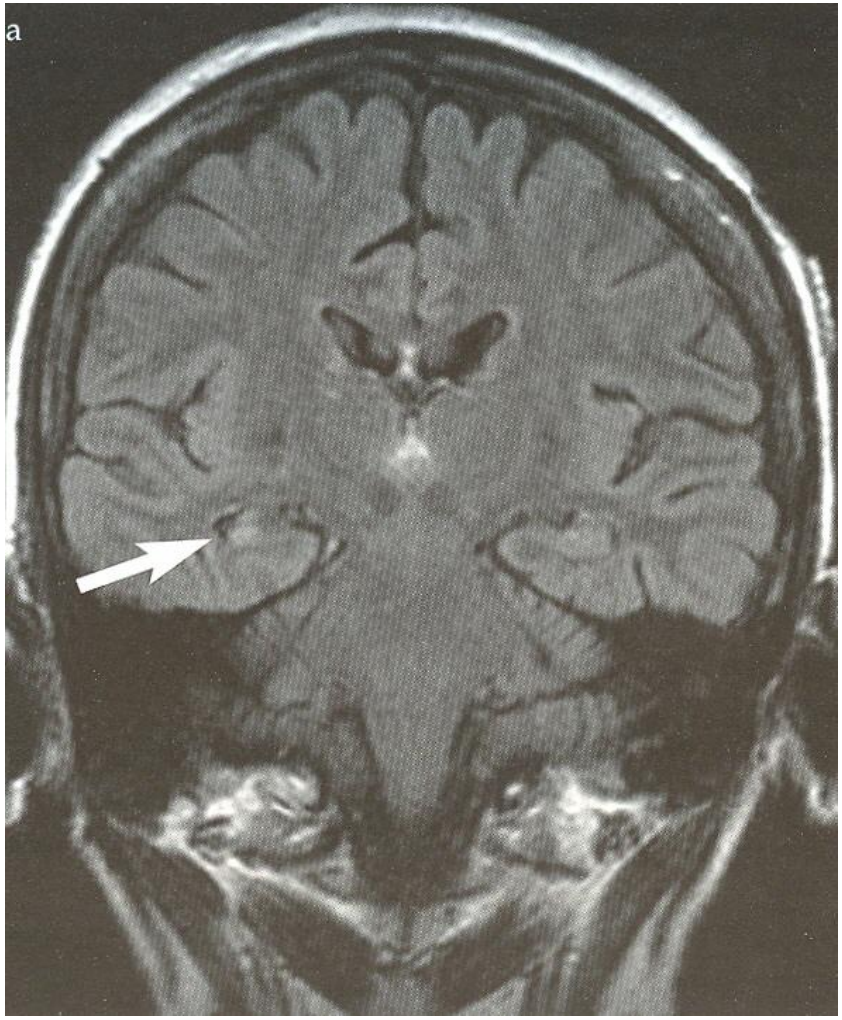
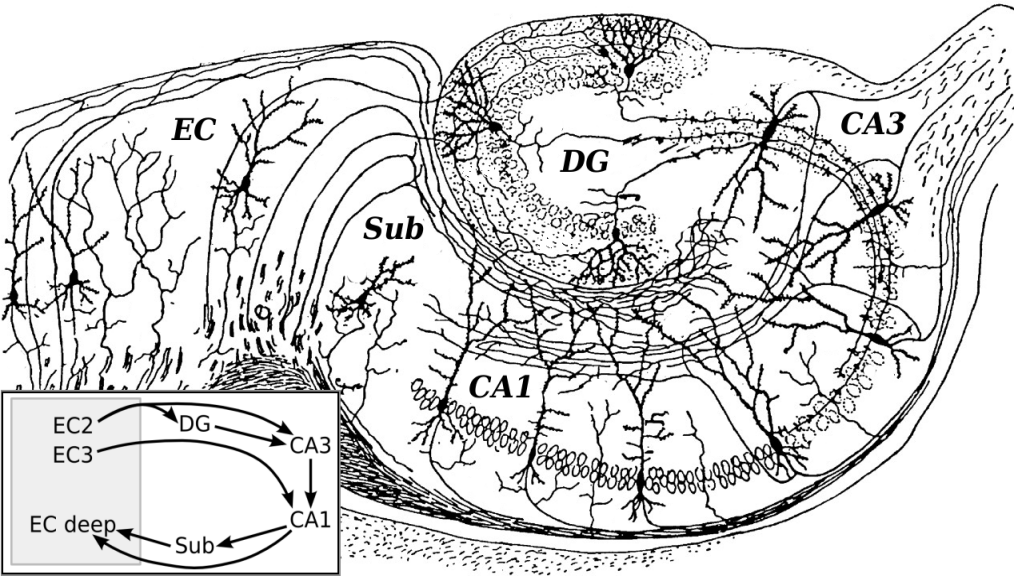
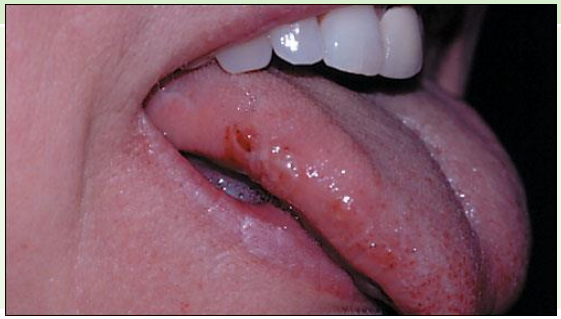








Syncope	Epileptic seizure
Prodromes, warning symptoms, gradual loss of consciousness	Sudden onset, sometimes aura
Motor symptoms are frequent (brief tonic, clonic or myoclonic activity), appear with latency after loss of consciousness.	Obvious motor manifestation – generalized tonic-clonic convulsions**. Never a flaccid motionless loss of consciousness with eyes closed.**
Rapid recovery of consciousness	Slow recovery of consciousness through confusion and drowsiness
No tongue biting	Tongue biting 

Psychogenic non-epileptic seizures (PNES)

- The most common condition misdiagnosed as epilepsy. Common in general population.

- **Somatoform/dissociative disorders** – unconscious production of physical symptoms because of unconscious psychological conflict (e.g. traumatic experience in childhood), the symptoms are not under voluntary control.
- **Factitious disorder** – the patient is intentionally producing, faking the symptoms, but the reason for doing so is unconscious
- **Malingering**

- Subtypes with motor manifestation or with motionless unresponsiveness (pseudosyncope)

Psychogenic non-epileptic seizures

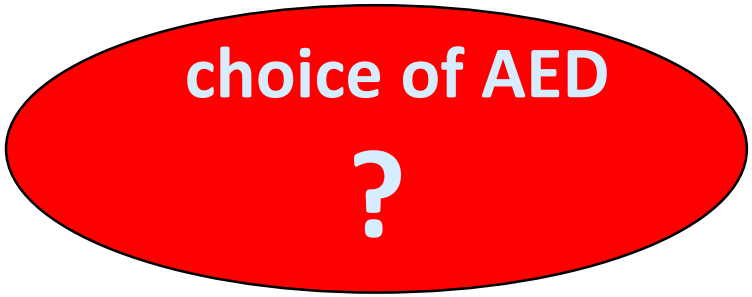
- **Typical features:**
  - Resistance to antiepileptic treatment
  - A very high frequency of seizures
  - Specific triggers unusual for epilepsy (stress, getting upset, pain, certain movements, etc.)
  - Seizures only in the presence of audience
  - Another somatoform symptoms (chronic fatigue syndrome, fibromyalgia, chronic pain, etc.)
  - The psychosocial history, psychiatric diagnoses
- The diagnostic standard is video-EEG

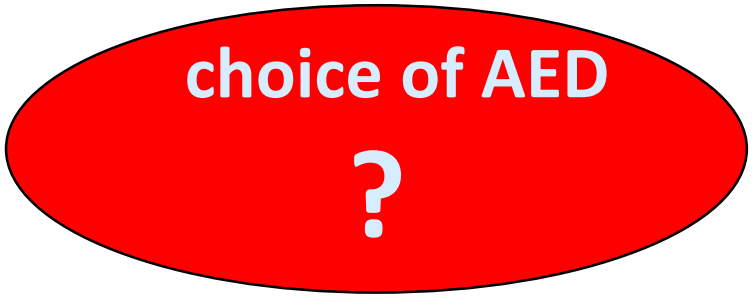
What to do after first epileptic seizure

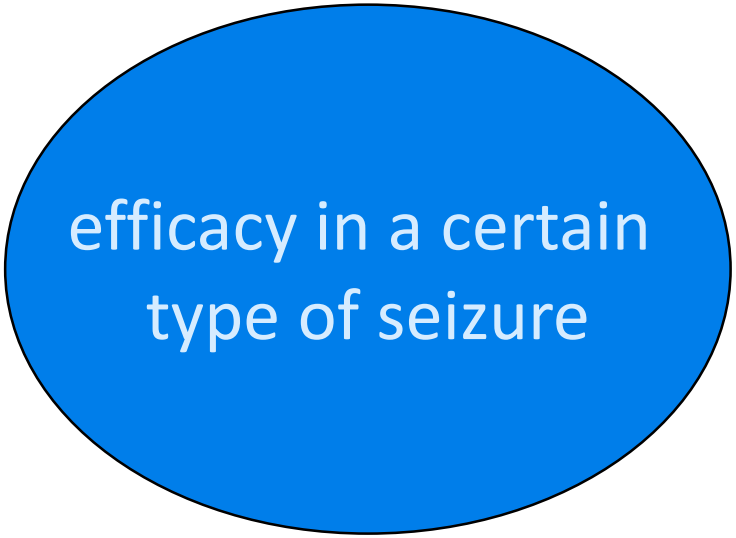
- Detailed history – from the patient, and an eyewitness
- Blood tests
- CT in emergent situations, otherwise MRI
- Exclusion of acute symptomatic seizure
- The initiation of long-term antiepileptic treatment is not needed in non-complicated cases with low recurrence risk

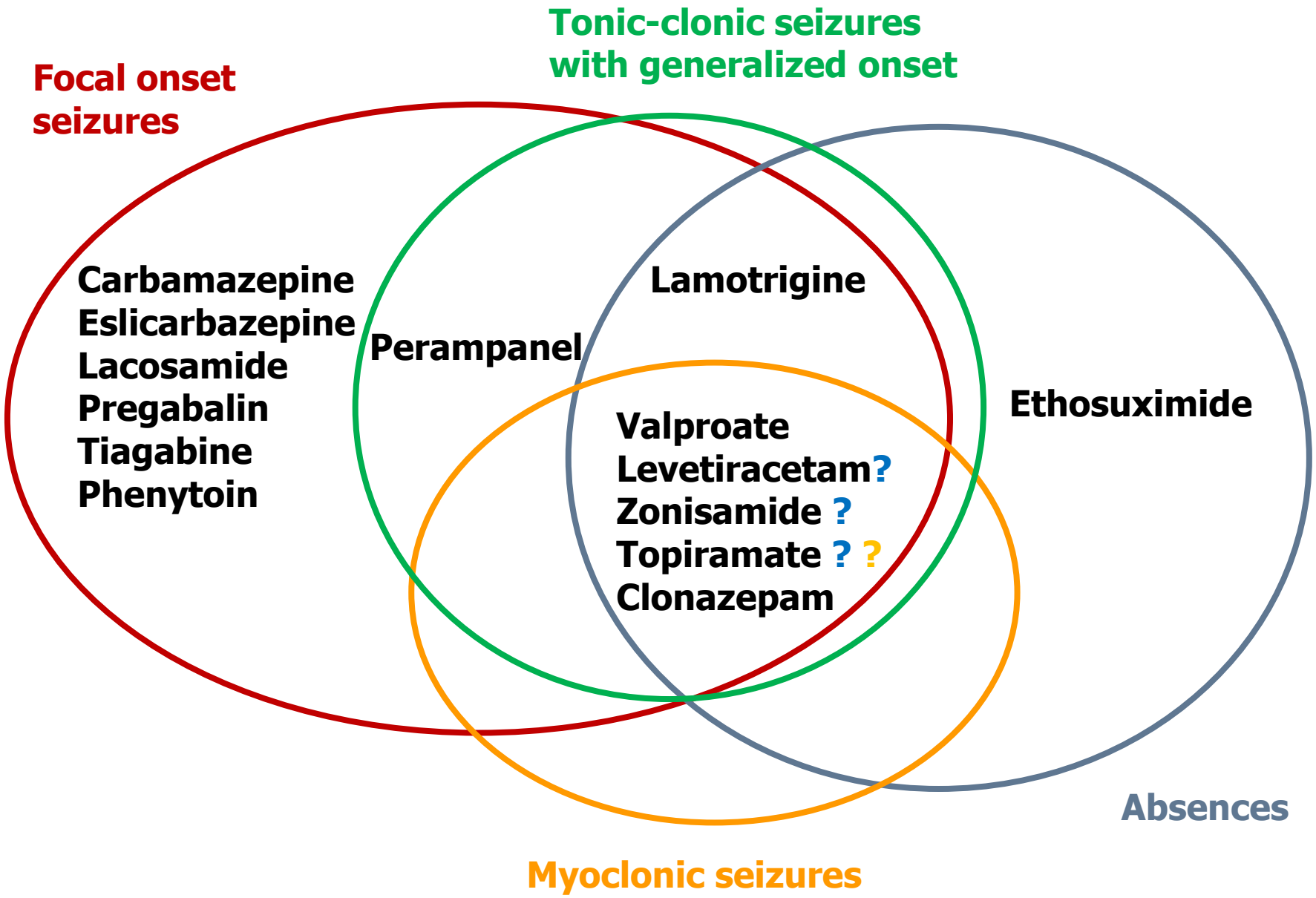
Guidelines for therapy

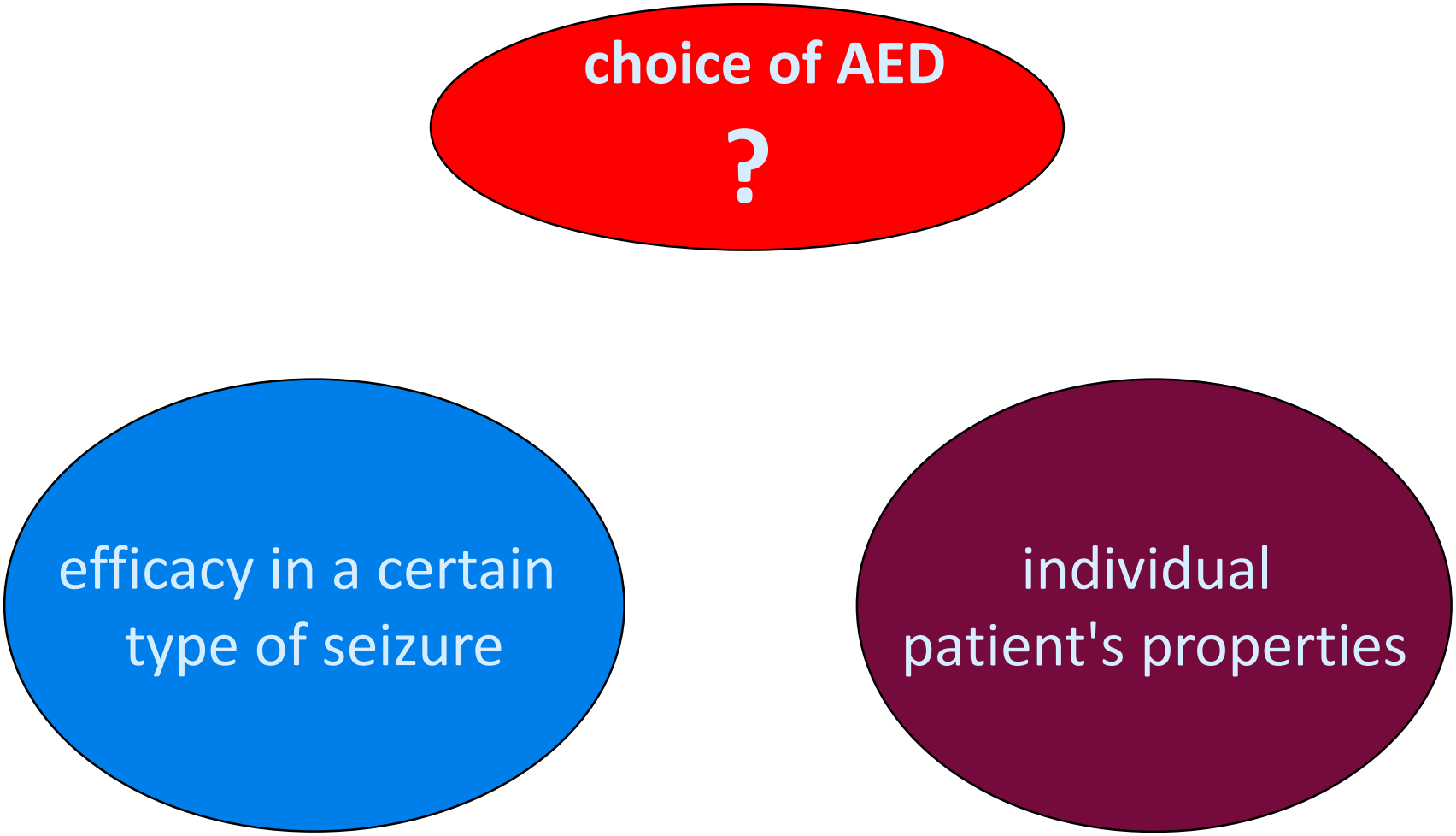
- Monotherapy is preferred – effective in 65% of patients, in 50% of them initial monotherapy effective
- Treatment should only be started when the diagnosis is certain.
- Treat the patient, not the EEG!
- In most patients, the treatment is initiated after 2nd unprovoked seizure (the risk for another seizure is 60-90%).
- After a single unprovoked seizure, risk for another is 20-45%. In some situations, the risk of seizure recurrence is higher and the treatment should be started after a single seizure.
- In some cases the treatment can be discontinued after some time.


choice of AED
?


choice of AED
?


efficacy in a certain
type of seizure


Focal onset seizures
Tonic-clonic seizures with generalized onset
Carbamazepine
Eslicarbazepine
Lacosamide
Pregabalin
Tiagabine
Phenytoin
Perampanel
Lamotrigine
Valproate
Levetiracetam?
Zonisamide ?
Topiramate ? ?
Clonazepam
Ethosuximide
Absences
Myoclonic seizures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?
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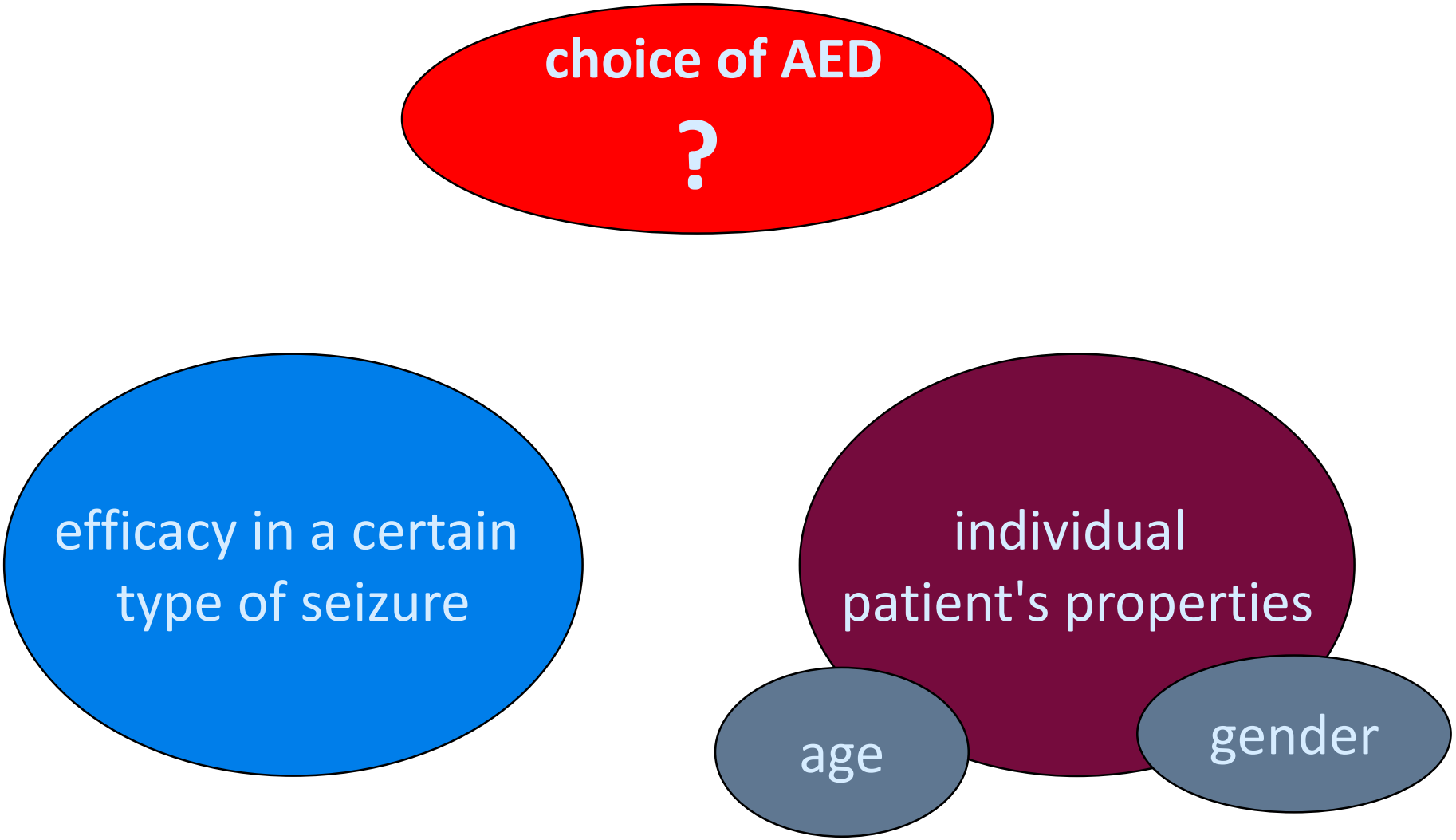
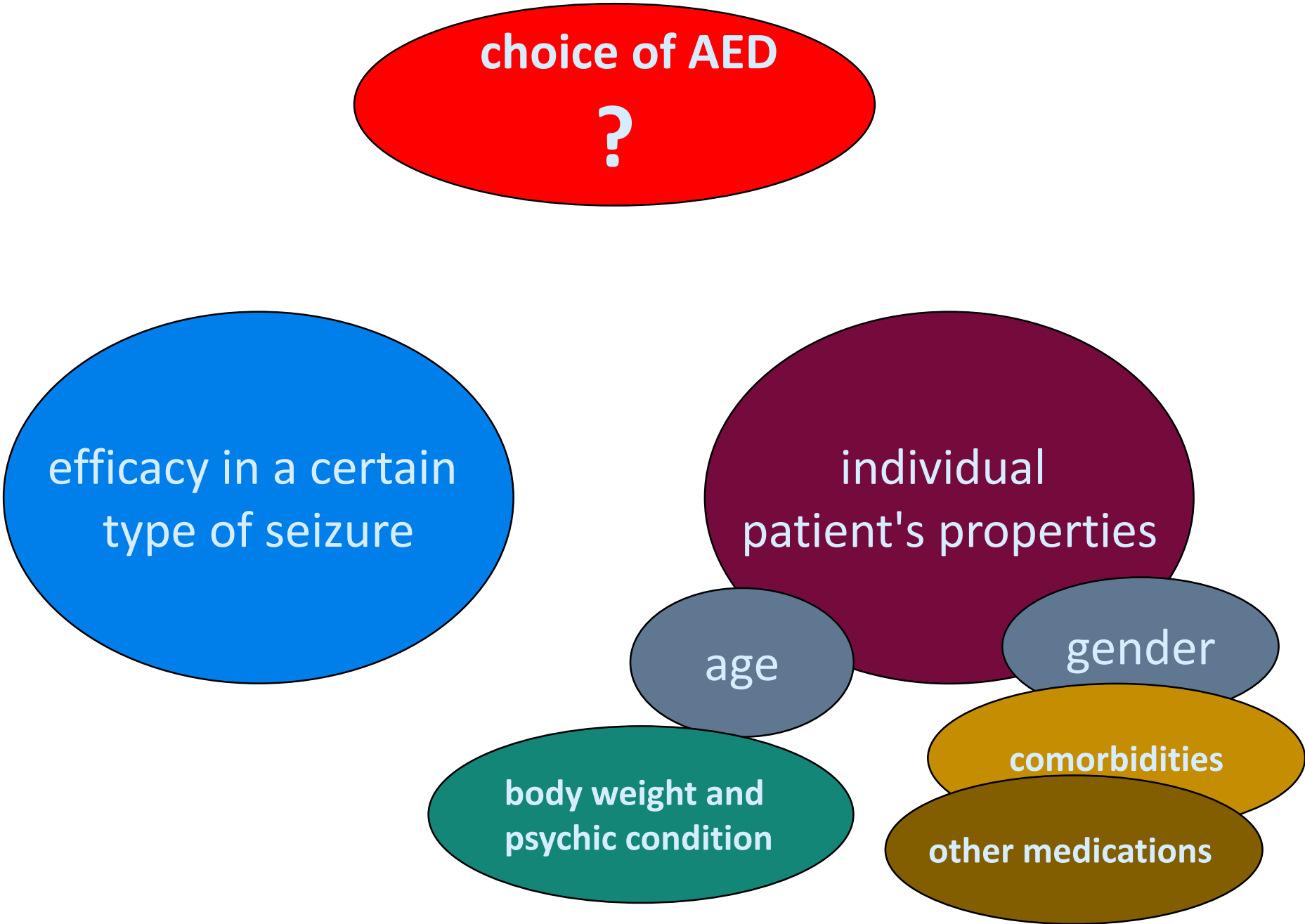
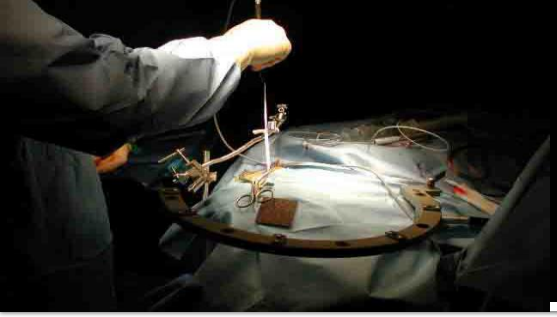
individual patient's properties


choice of AED
?
efficacy in a certain type of seizure
individual patient's properties
age
gender


choice of AED
?
efficacy in a certain type of seizure
individual patient's properties
age
gender
comorbidities
body weight and psychic condition
other medications

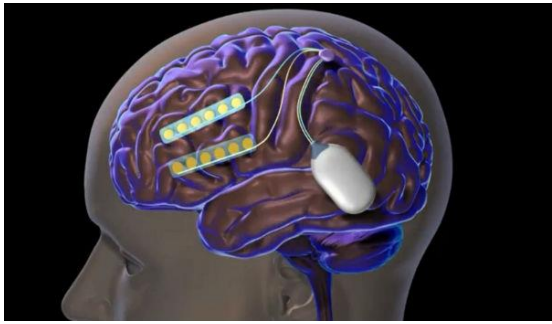


Neurosurgery

- In 30% of patients the seizures are insufficiently controlled by AED
- Pharmacoresistance = continued occurrence of seizures despite maximum tolerated doses of 2 appropriate AEDs

Neurosurgery

- **Resective surgery**
  - anteromesial temporal resection, amygdalohippocampectomy
  - lesionectomy, topectomy
- **Vagus nerve stimulator**
- **Responsive neurostimulation**
- **Stereotactic thermocoagulation**



Status epilepticus - definition

- Condition resulting either from the **failure of the mechanisms responsible for seizure termination** or from **the initiation of mechanisms which lead to abnormally prolonged seizures** (after time point t1).
- Can have long-term consequences – neuronal injury, neuronal death, alteration of neuronal networks (after time point t2).

Status epilepticus - classification

A. WITH PROMINENT MOTOR SYMPTOMS

- 1. convulsive (tonic-clonic)
- 2. myoclonic
- 3. focal motor

B. WITHOUT PROMINENT MOTOR SYMPTOMS

- 1. non-convulsive SE in coma
- 2. absence status
- 3. focal non-motor

Status epilepticus - classification

A. WITH PROMINENT MOTOR SYMPTOMS

B. WITHOUT PROMINENT MOTOR SYMPTOMS

Consciousness impaired

- 1. convulsive (tonic-clonic)
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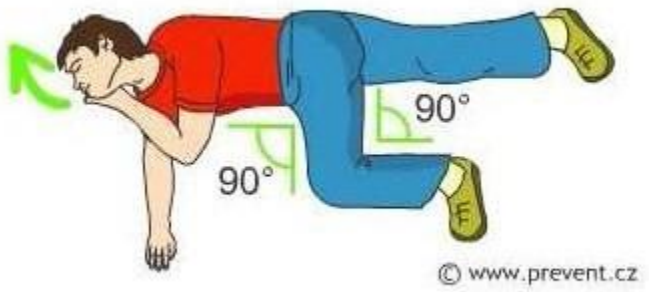
Convulsive status

- One of the most important emergencies in neurology; mortality rate 10-20%
- Urgent and qualified treatment is necessary
- In some cases continual application of anesthetics with EEG monitoring is necessary

First aid in epileptic seizure

- Do not restrain convulsive movements, protect the head, protect the patient from trauma
- Do not put anything in the mouth
- Check for breathing when the seizure is over, remove an airway obstruction if necessary
- Put the patient in the recovery position



Treatment of epileptic seizure and convulsive status epilepticus

- 90% of non-complicated convulsive seizures last less than 2 minutes, rarely 5 minutes – **every seizure or series of seizures without restoration of consciousness between them lasting more than 5 minutes (time point t1) must be treated as status epilepticus**

- management of SE should be aimed at:
  - maintenance of vital functions
  - treatment of a cause of SE
  - treatment of convulsive activity

Treatment of epileptic seizure and convulsive status epilepticus

- venous access, free airways, blood tests: glucose, ions, urea, creatinine, liver enzymes, blood count, antiepileptic drugs blood levels, toxicology
- 5-15 minutes: diazepam 10 mg i.v. or 10 mg per rectum, the same dose to be repeated twice after 5 minutes, or alternatively, midazolam 10 mg i.m. (< 40kg 5 mg), if there is no effect

- 15-60 minutes: phenytoin 20 mg/kg (50 mg/min.)
  or valproate 40 mg/kg (5 mg/kg/min.)
  or levetiracetam 60 mg/kg (5 mg/kg/min.)

- 6O minutes and more: intubation, i.v. anesthesia: thiopental, alternatively propofol or midazolam

Treatment of non-convulsive and focal SE

- In **absence status** small dose of benzodiazepines is sufficient.
- In **focal status** the treatment is also more conservative, without application of anesthetics

Thank you for your attention