Seizures

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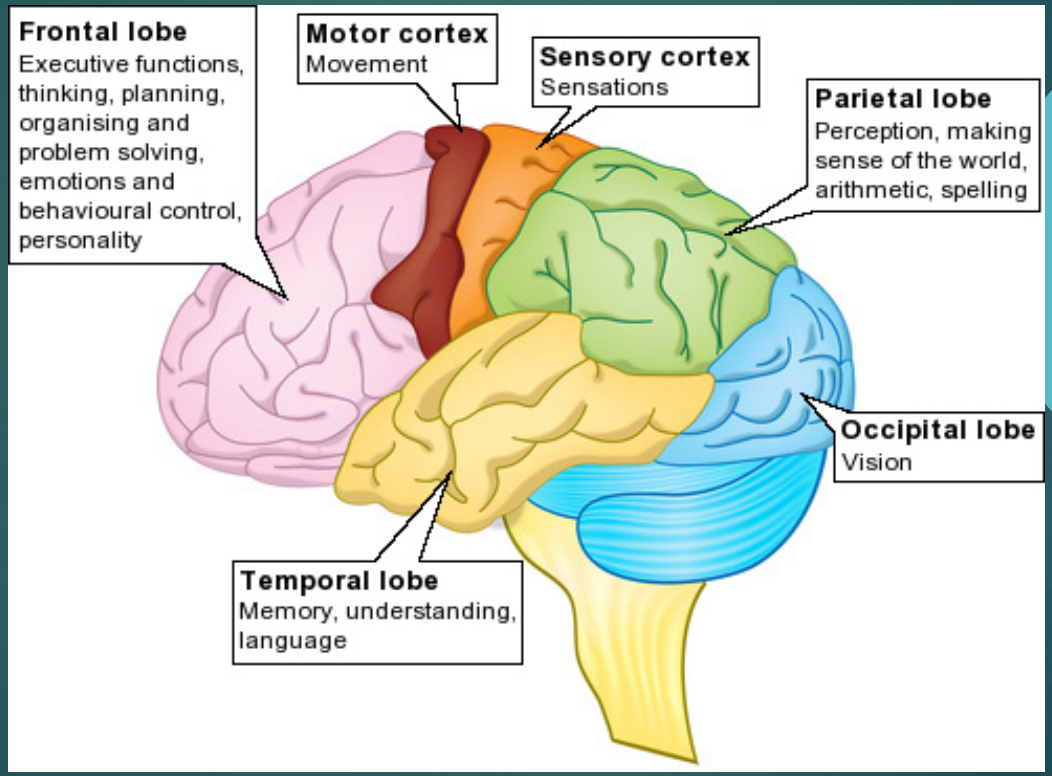
Seizure: definition

- Abnormal, repetitive neuronal discharges
- Self-limited
- Evolution in:
  - Time
  - Amplitude
  - Morphology
  - Space

Seizure = symptom

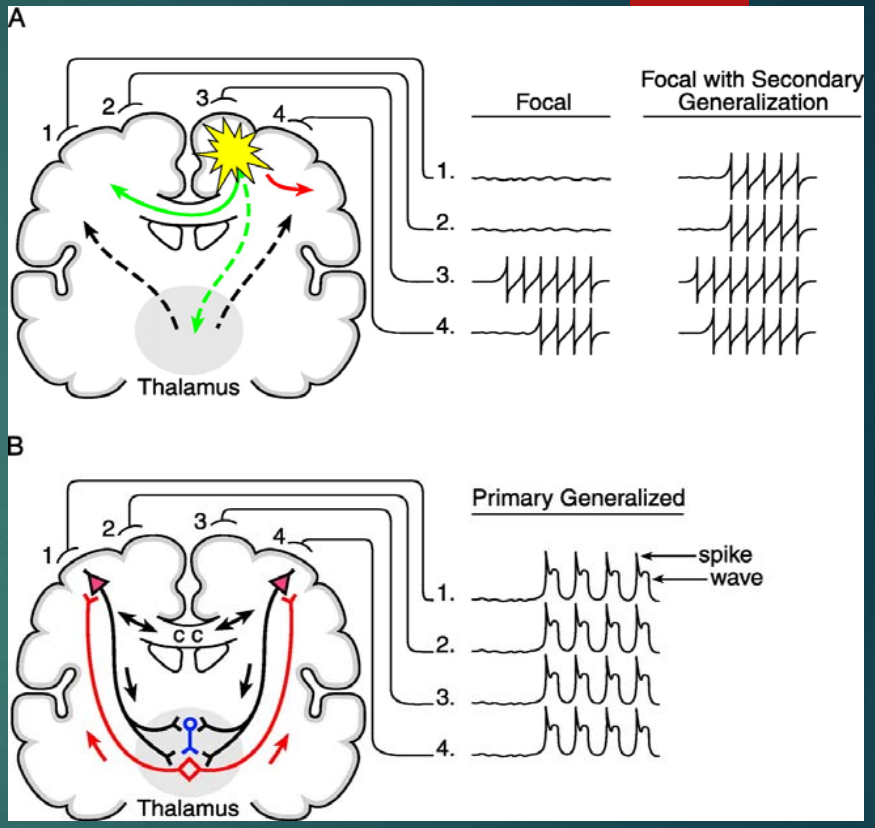
- Genetic
- Acquired
  - Vascular
    - stroke
    - AVM
    - SAH
    - cavernous malformation
  - Infectious
    - HSV
    - neurocysticercosis
    - CJD
  - Traumatic
    - SDH
  - Autoimmune
    - SLE
  - Metabolic
    - hypo-
      - Na/K/Ca/Mg
      - glu
    - hyper-
      - thyroid
      - temperature
  - Iatrogenic
  - Neoplasm

Structure = semiology



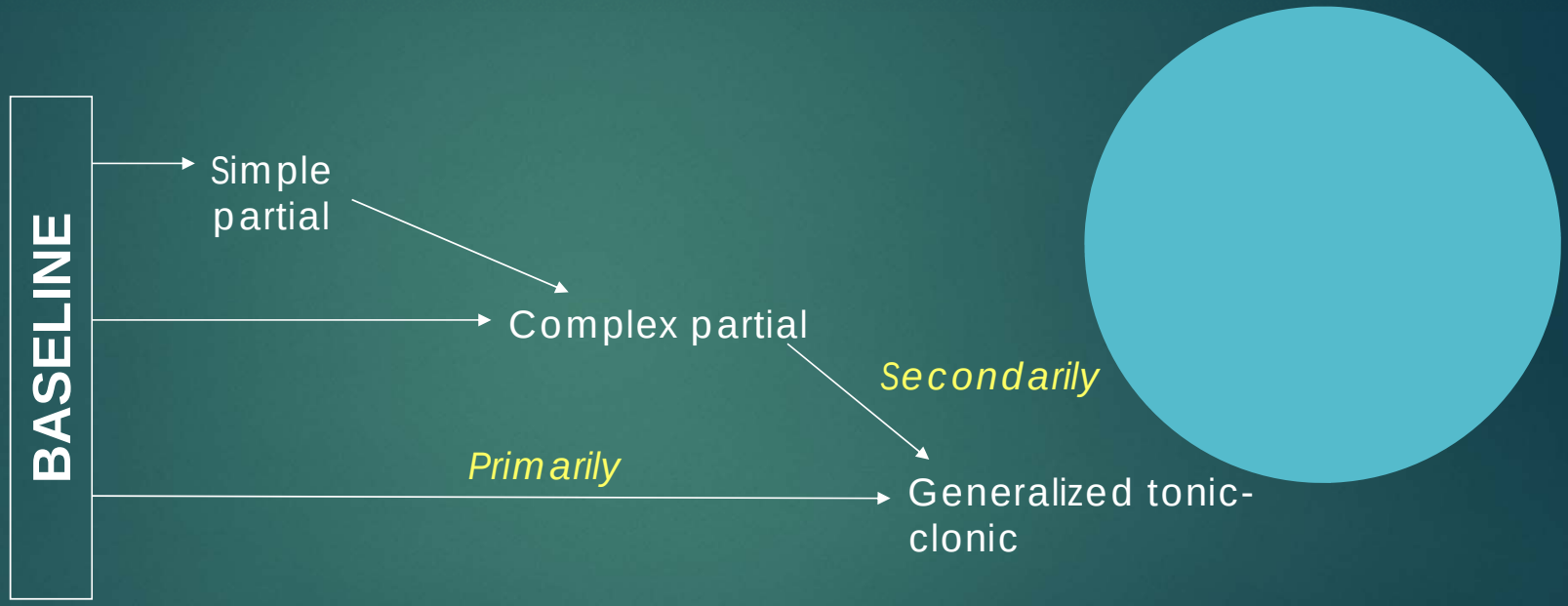
Seizure classification

- Partial
  - Simple
  - Complex
- Generalized
  - Tonic-clonic
  - Absence
  - Myoclonic
  - Tonic
  - Clonic
  - Atonic

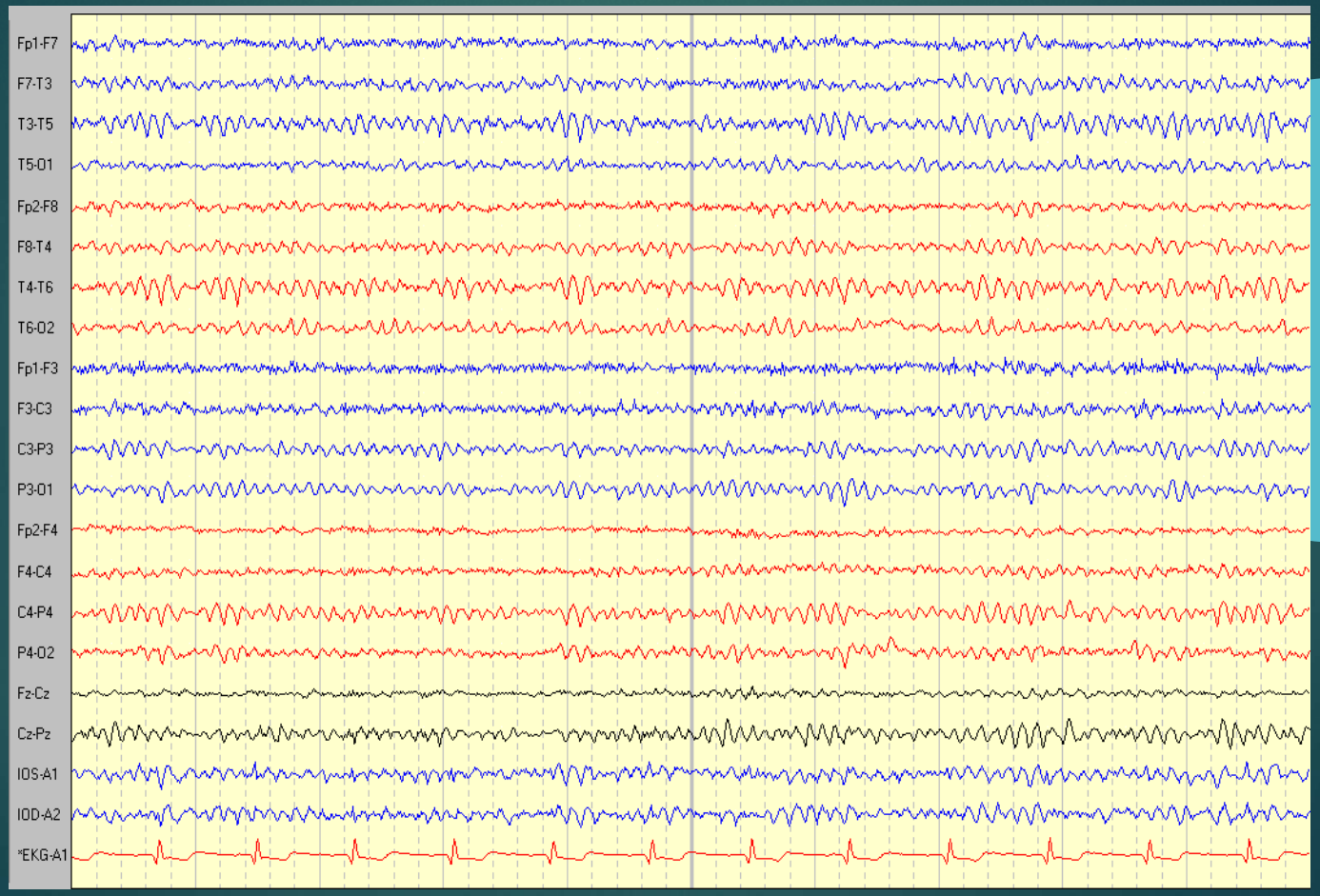


"Petite mal" versus "Grand mal"

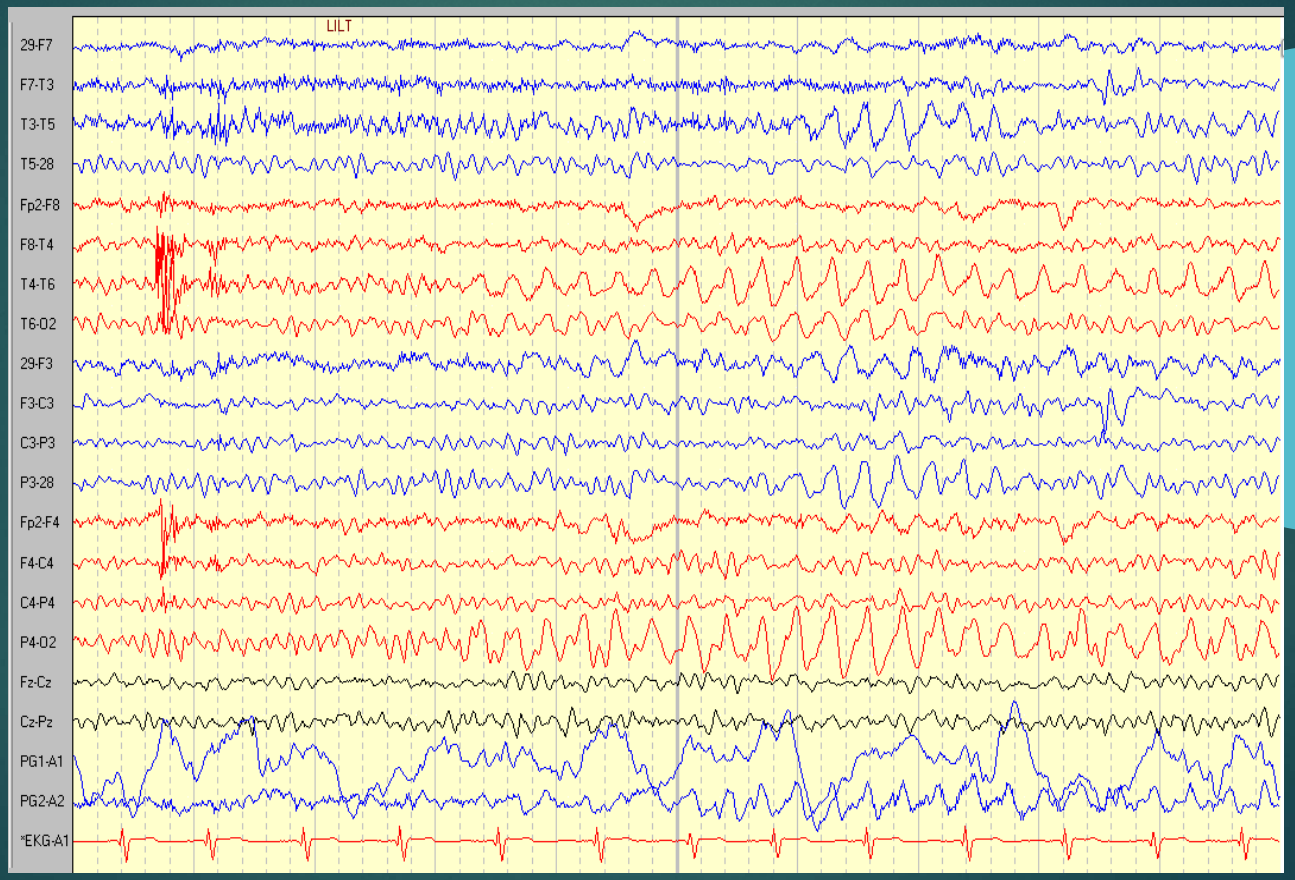
Seizure classification



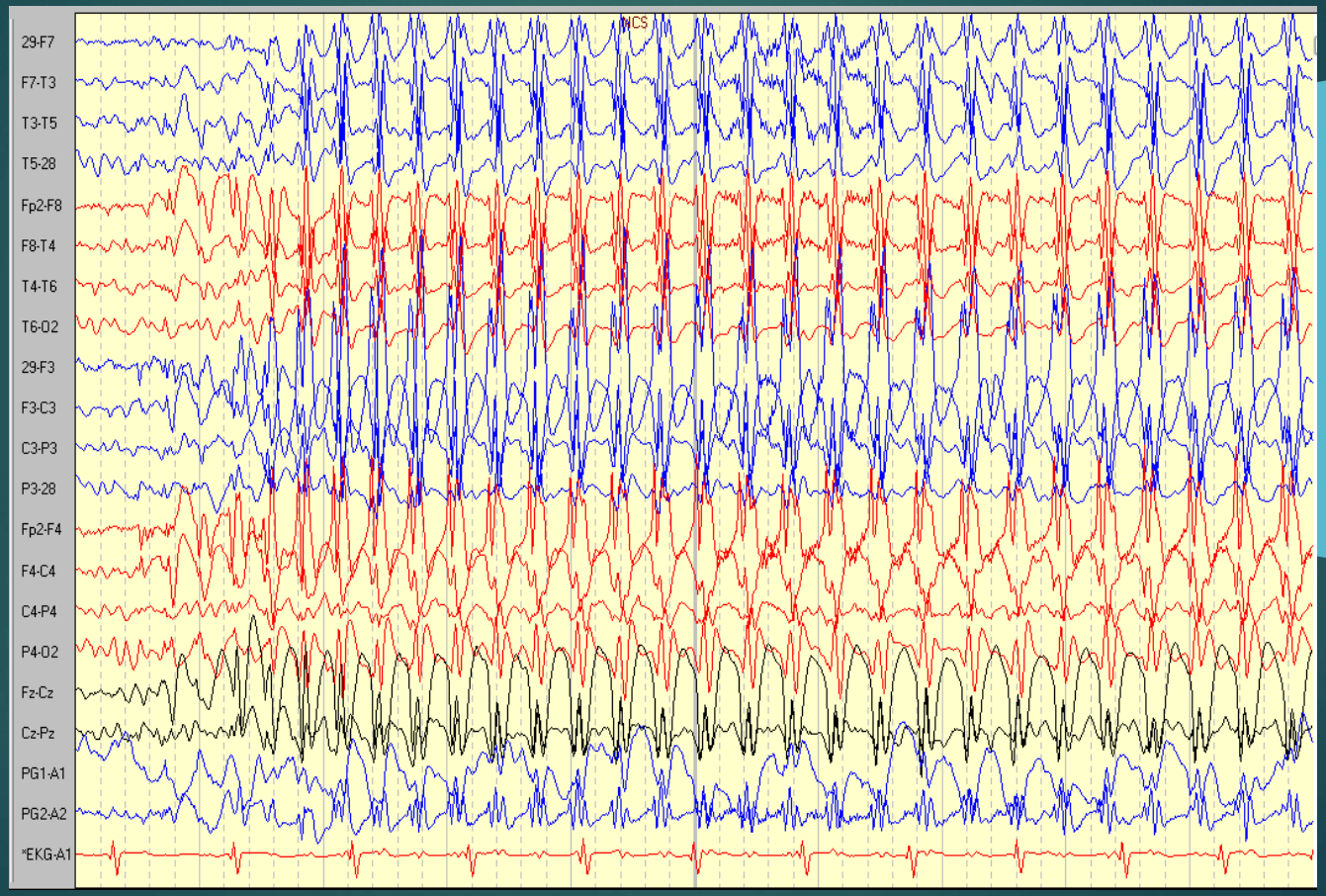
Normal wake EEG



Seizure EEG


LILT
29-F7
F7-T3
T3-T5
T5-28
Fp2-F8
F8-T4
T4-T6
T6-O2
29-F3
F3-C3
C3-P3
P3-28
Fp2-F4
F4-C4
C4-P4
P4-O2
Fz-Cz
Cz-Pz
PG1-A1
PG2-A2
*EKG-A1

Seizure EEG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C4-P4
P4-O2
Fz-Cz
Cz-Pz
PG1-A1
PG2-A2
*EKG-A1

GTC

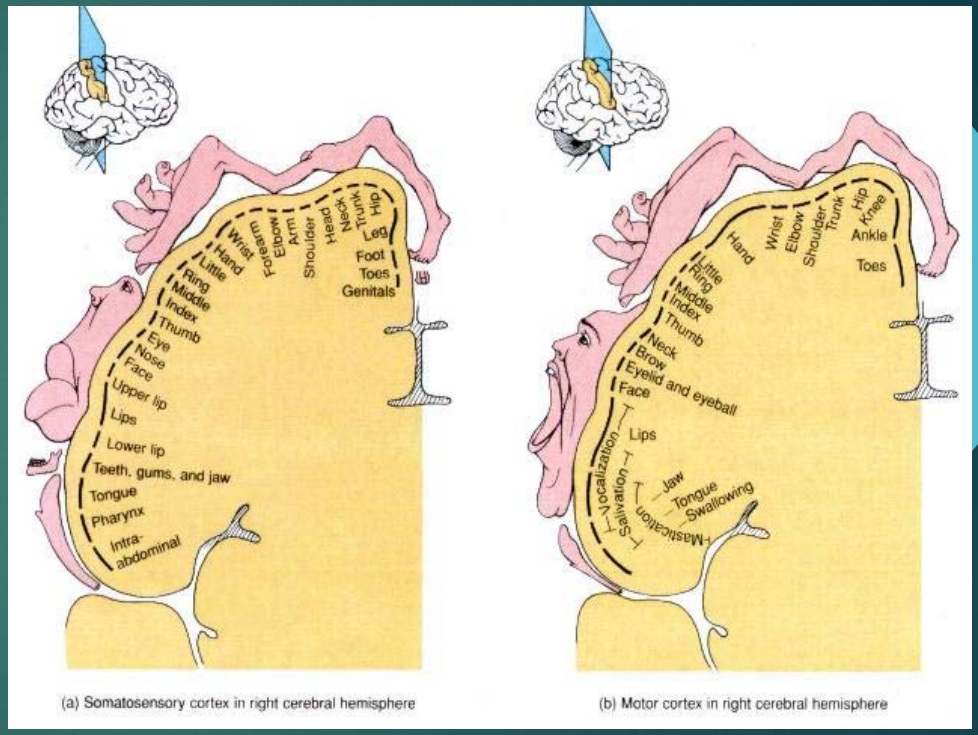
- GTCs account for 23% of epilepsy incidence
- Primary or secondary
  - Tonic
    - Flexor spasm of axial muscles
    - Eyes up, pupils dilate
    - Tonic extension – tongue biting
  - Clonic
    - Flexor spasms 8Hz to 4Hz – pupillary contract/dilate
    - Urinary/bowel incontinence
- Duration 1-2 minutes
- “grand mal”

Absence

- Incidence of 1/10,000
- Prevalence of 2.3% - 37.7%
- Generalized, 3Hz spike and wave
  - Thalamocortical circuit
- Eyelid/eye clonus, oral automatisms
- “petite mal”

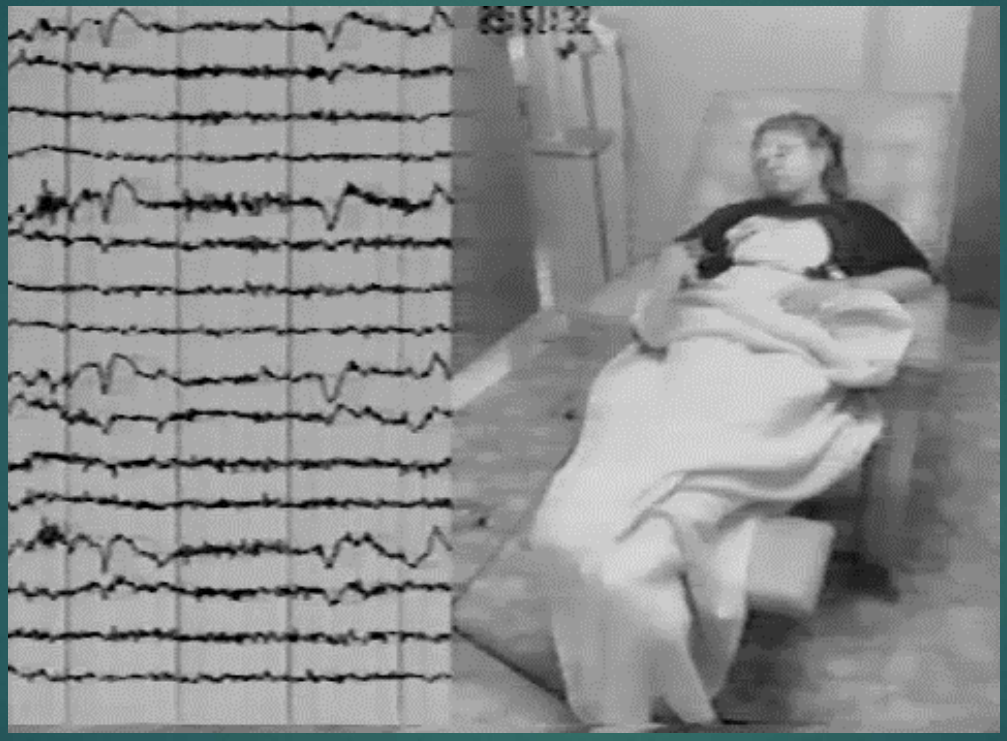
Simple partial

- Consciousness preserved
  - Memory intact
- Sensory, motor, psychic
  - “aura”
  - Jacksonian march (2.2%)



Complex partial

- CPS 26% of all seizures
- Consciousness affected
  - Lost time
- Automatisms as “release” symptoms
  - Oral
  - hand

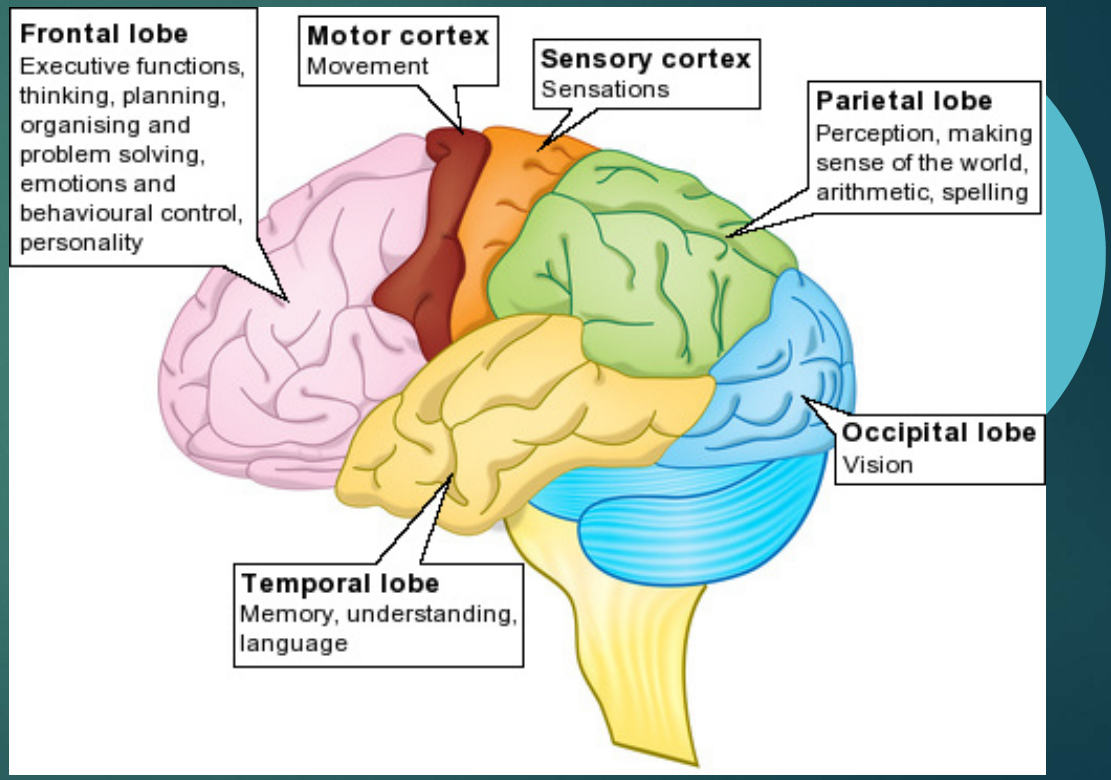


Myoclonic

- Involuntary, quick movements with abrupt, lightening-like character
- Entire body or focal
  - Myo = muscle
  - Clonus = tumult/quick movement
  - Myoclonic jerk is redundant
- Generalized

Frontal

- Explosive
- Awake
- Intact memory



Psychogenic Nonepileptic Seizure

- Conversion disorder
- Variable
  - Duration
  - Intensity
  - Lateralization
  - Axis
- Semiology
  - Back arching
  - Eye closure
  - Pelvic thrusting

Differential diagnosis

TABLE 10. Characteristics of Seizures and Common Mimics in Adults

Characteristic	Epileptic Seizure	Psychogenic Nonepileptic Seizure	Syncope	TIA	Migraine	Vertigo
Warning/aura	Variable (<1 min)	Variable	Lightheaded feeling, sweating	None	Variable (15-30 min)	None
Duration	1-2 min	5-15 min	Seconds to minutes	5-30 min	Hours	Minutes to days
Position dependent	No	No	Typically, but not always	No	No	Often on standing or moving head, but not always
Symptoms during episode	Variable: automatisms, confusion, aphasia, tonic-clonic movements	Pelvic thrusting, jerking that waxes and wanes, forced eye closure	Loss of tone, brief tonic extension or clonic jerks	Hemiparesis, hemisensory loss, visual loss, aphasia	Visual disturbance, vertigo, paresthesias, aphasia, dysarthria	Nausea, ataxia
Altered consciousness	Common	Common	Common	Rare	Rare	No
Incontinence	Variable	Variable	Variable	None	None	None
Heart rate	Increased	Variable	Irregular and decreased	Variable	No effect	Variable
Symptoms after episode	Confusion, fatigue	Variable	Alert	Alert	Fatigue	Alert
EEG during event	Epileptiform pattern	Unaltered	Diffuse slowing	Focal slowing	Rare slowing	Unaltered

EEG = electroencephalogram; TIA = transient ischemic attack.

Seizure treatment

- ABC's
- Check for provoking factors
- If abnormal neurological exam,
  - HCT for hemorrhage
  - MRI for intraparenchymal etiology
  - EEG for focal/generalized to guide potential therapy

Status epilepticus: Rapid Response

- Seizure activity lasting > 5min
- Serial seizures without return to baseline

- Mortality
- Morbidity

Status epilepticus: Treatment

Time = brain

Prolonged epileptic seizure: premonitory stage/out-of-hospital (non-medical persons)

Time	Drug treatment		General measures	Emergency investigations
5 min	**Adults:** Diazepam 10mg rectally	**Children:** Diazepam 0.5 mg/kg rectally	• Airway • Breathing • Circulation	• Glucose (glucometer)
	Repeat once if necessary			

If seizure continues, proceed

Early status epilepticus: first stage/out-of- or in-hospital (medical personnel)

Time	Drug treatment		General measures	Emergency investigations
5–30 min	**Adults:** IV lorazepam 4mg bolus or IV diazepam 10mg	**Children:** IV lorazepam 0.1 mg/kg or IV diazepam 0.3 mg/kg	• Airway; oxygen • Cardiorespiratory function and regular monitoring; ECG, blood pressure, SpO_2 • IV access; IV glucose, thiamine, pyridoxine (children) • Treat acidosis	• Glucose, sodium, potassium, calcium, CRP, Astrup • Concentrations of AEDs • Toxicology screening • Kidney and liver function tests
	Repeat after 5 min. if necessary			

If seizure continues, proceed

Established status epilepticus: second stage/emergency department

Time	Drug treatment	General measures	Emergency investigations
30–60 min	IV fosphenytoin 15–18 mgPE/kg at max. rate of 150 mgPE/min or IV phenytoin 15–18 mg/kg at max. rate of 50 mg/min **or in children:** IV phenobarbital 15–20 mg/kg at max. rate of 100 mg/min	• Cardiorespiratory function and monitoring • ECG, blood pressure, SpO_2, use pressors if needed • Identify and treat medical complications	• CT scan for aetiology • CSF for CNS infection • EEG for pseudostatus epilepticus

If seizure continues, proceed

Refractory status epilepticus: third stage/intensive care unit

Time	Drug treatment	General measures	Emergency investigations
>60 min	General anaesthesia; Thiopental sodium 3–5 mg/kg bolus, then 3–5 mg/kg/h or Pentobarbital 10–15 mg/kg, then 0.5–1 mg/kg/h or Midazolam 0.2 mg/kg boluses, max. 2 mg/kg, then 0.05–2 mg/kg/h **or only in adults:** Propofol 1–2 mg/kg boluses, max. 10 mg/kg, then 2–4(–10) mg/kg/h	• Intensive care; ventilatory and haemodynamic treatment • Increased intracranial pressure; measure and treat if signs • Anaesthesia continued for 12–24 hours after last clinical or electrographic seizure • Optimise maintenance AED treatment	• Continuous EEG monitoring; electrographic seizures, depth of anaesthesia (burst-suppression) • Monitor Astrup, potassium, sodium, glucose, lactate, concentrations of AEDs

Epilepsy definition

- 2+ unprovoked seizures
- 1 unprovoked seizure + evidence of increased risk

Epilepsy Syndromes

- Primary/Idiopathic Generalized Epilepsy (PGE/IGE)
  - Childhood Absence Epilepsy
  - Juvenile Myoclonic Epilepsy
    - GTC, AM myoclonic jerks, +/- absence
- Localization-related Epilepsy
  - Temporal lobe
    - Déjà vu, anxiety, oral/hand automatism
  - Frontal lobe
    - Nighttime, explosive

Epidemiology

- US incidence
  - 150,000 per year.
  - 48 per every 100,000
  - 1 in 26 people will develop epilepsy
- US prevalence
  - 2.2 million people.
  - 7.1 in every 1,000 people
  - 16.5 in every 1,000 people had epilepsy at some point in their life

Epilepsy: Treatment

- Medications
- Resective surgery
- Devices
- Ketogenic diet

Epilepsy: Medications

- "Old"
  - Dilantin
  - Depakote
  - Tegretol
  - Phenobarbital
  - Zarontin
  - Mysoline
  - Felbatol
- "Newer"
  - Lamictal
  - Keppra
  - Topamax
  - Zonegran
  - Neurontin
  - Lyrica
  - Trileptal
- "Newest"
  - Onfi
  - Aptiom
  - Vimpat
  - Fycompa
  - Gabatril
  - Sabril
  - Banzel
  - Potiga

EARLY IDENTIFICATION OF REFRACTORY EPILEPSY

PATRICK KWAN, M.D., AND MARTIN J. BRODIE, M.D.

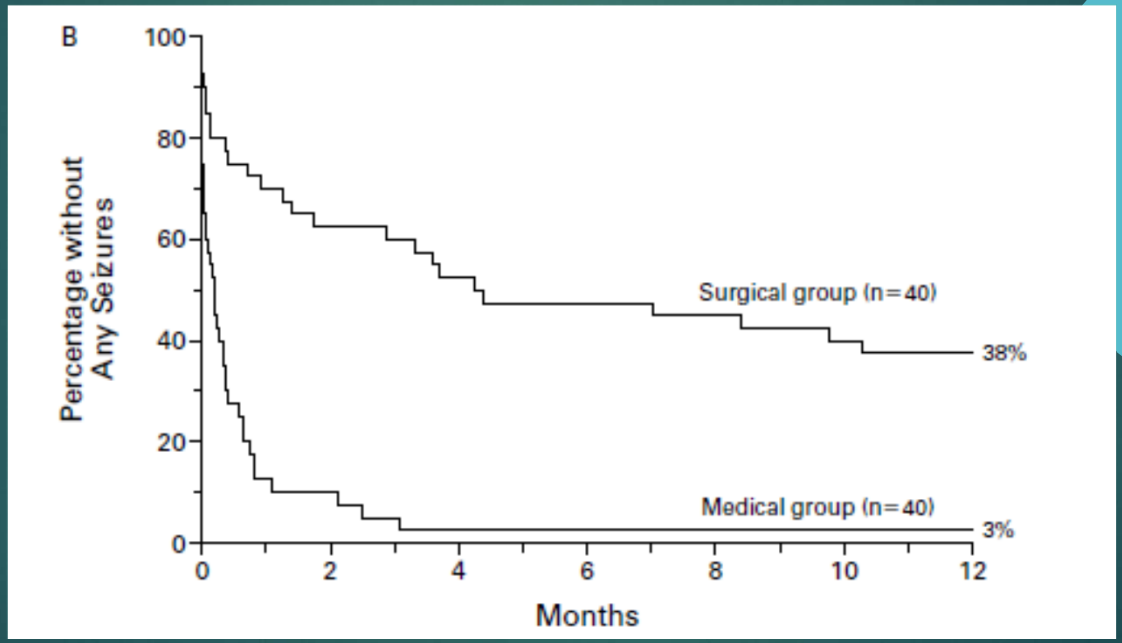
TABLE 2. SUCCESS OF ANTIEPILEPTIC-DRUG REGIMENS IN 470 PATIENTS WITH PREVIOUSLY UNTREATED EPILEPSY.

VARIABLE	No. (%)
Response to first drug	222 (47)
Seizure-free during continued therapy with first drug	207 (44)
Remained seizure-free after discontinuation of first drug	15 (3)
Response to second drug	61 (13)
Seizure-free during monotherapy with second drug	41 (9)
Remained seizure-free after discontinuation of second drug	20 (4)
Response to third drug or multiple drugs	18 (4)
Seizure-free during monotherapy with third drug	6 (1)
Seizure-free during therapy with two drugs	12 (3)
Total	301 (64)

Kwan P & Brodie MJ, NEJM (2000)

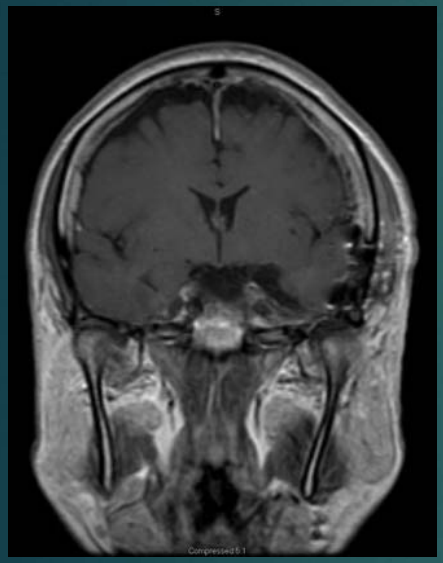
A RANDOMIZED, CONTROLLED TRIAL OF SURGERY FOR TEMPORAL-LOBE EPILEPSY

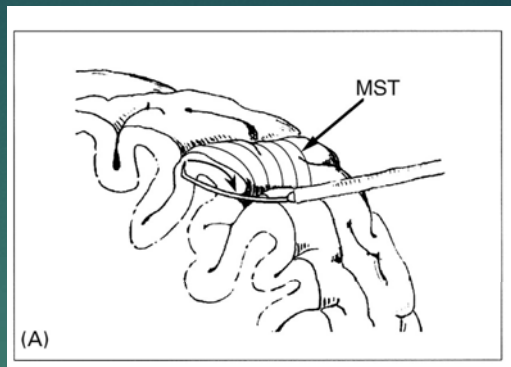
SAMUEL WIEBE, M.D., WARREN T. BLUME, M.D., JOHN P. GIRVIN, M.D., PH.D., AND MICHAEL ELIASZIW, PH.D., FOR THE EFFECTIVENESS AND EFFICIENCY OF SURGERY FOR TEMPORAL LOBE EPILEPSY STUDY GROUP*

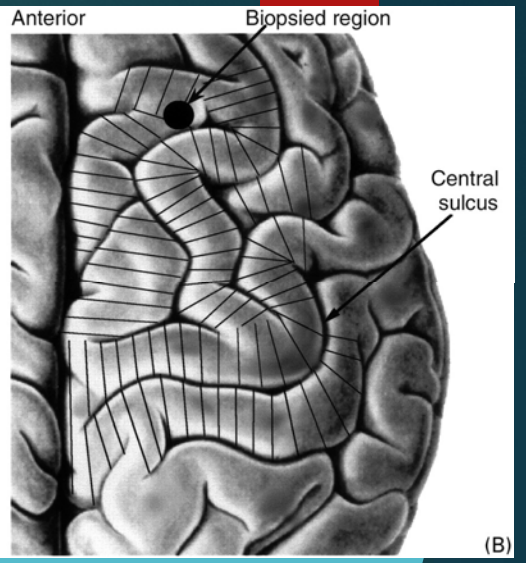


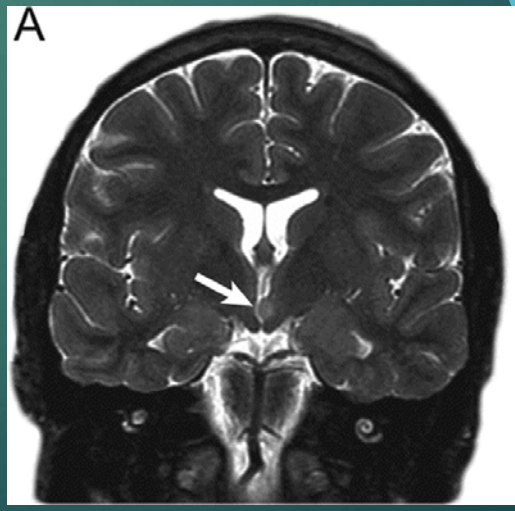
Wiebe et al. NEJM (2001)

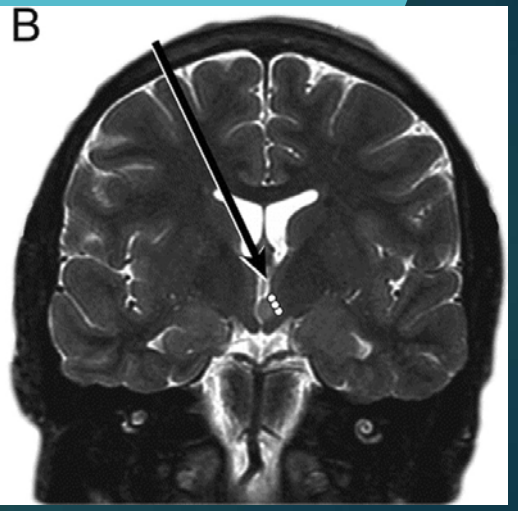
Epilepsy: Surgery



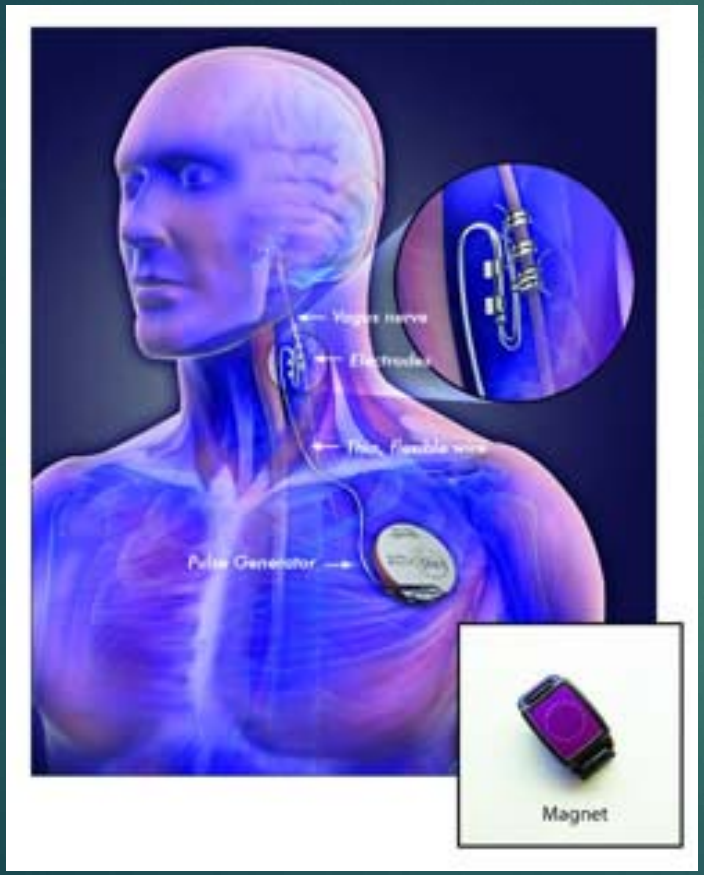


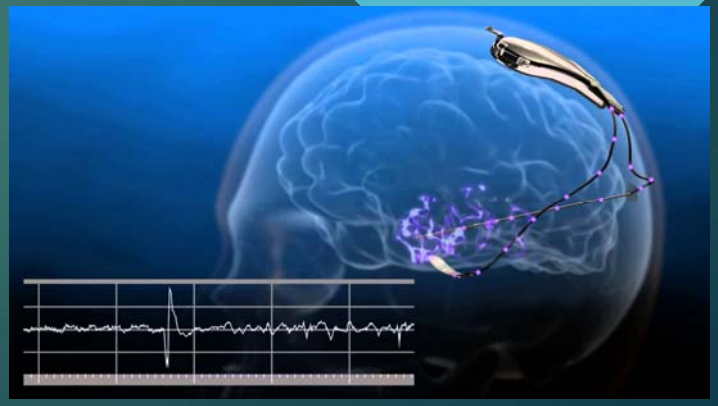






Epilepsy: Devices





Safety

- No hiking alone
- No swimming alone
- No cooking over hot stove alone
- Showers, not baths
- No working at heights

Driving

- State dependent
- AZ:
  - Self-reporting
  - 90 day seizure-free
  - Motor Vehicle Department makes the call

Pregnancy

- Malformation/miscarriage
- Medication effects
- Seizure effects

Summary

- Seizures are stereotypical but protean
- Watch for status epilepticus