بسم الله الرحمن الرحيم

# A brief review on epilepsy

***Y. Kholghi*** ***MD***

# Nosology

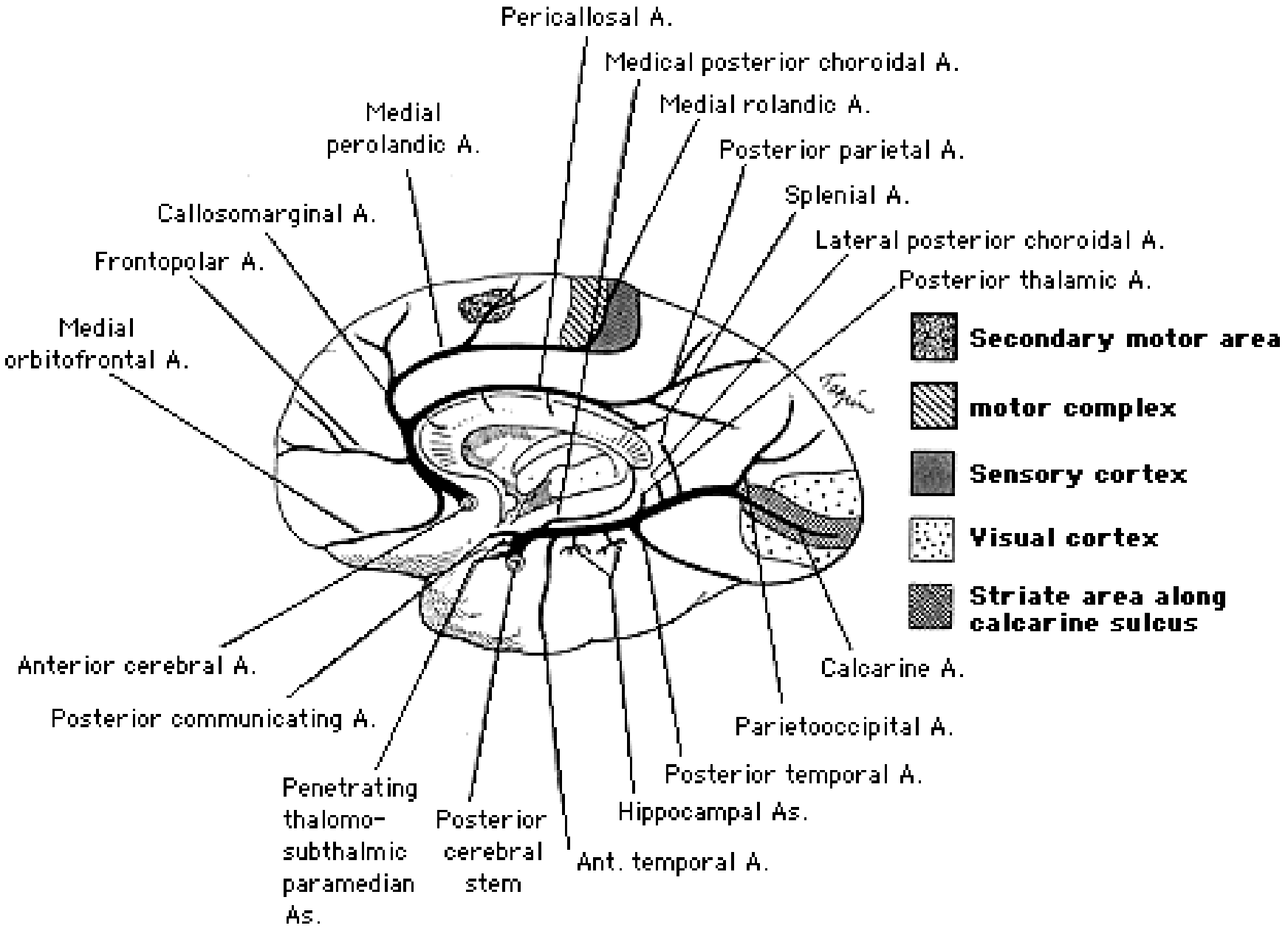
- Seizure
- Convulsion
- Epilepsy
- Active epilepsy

# Seizure:

Transitory focal or generalized electrical discharge of cerebral neurons, that creates involuntary motor, sensory, behavioral and psychic presentations.

Affect 1.5-5.0% of population in life.

# Anterior Cerebral Artery Distribution and Signs and Symptoms of Occlusion†



# Shapes of seizure:

- Convulsive
- Non-Convulsive

# What is Epilepsy?

- Defined as 2 or more seizure.
- Incidence rate:

  Developed countries

  40-70 per 100,000

  Developing countries

  100-190 per 100,000

# Types of Epilepsy:

- **Partial** (focal).
- **Generalized** (GTC, Absence, Clonic, Myoclonic, Tonic, and Atonic epilepsy).

# Active Epilepsy:

- Persons who take anticonvulsant drugs.
- Had a seizure in the past 5 years.

# Prevalence of Active Epilepsy:

**Developed countries:**

4-10 per 10,000.

**Developing countries:**

57 per 10,000.

# WHO Report:

- 40 million people in world.
- 80 percent in developing countries.
- 30-40 percent refractory seizure.
- 5 percent needs surgery.

# Causes of higher incidence and prevalence in developing countries:

- Birth injury
- Head trauma
- Poor sanitation
- Infection
- Poverty and Illiteracy
- Alcohol and Substance abuse.

# Etiology:

- Etiology identified in 25-35 percent of patients.

# Etiology in Pediatrics:

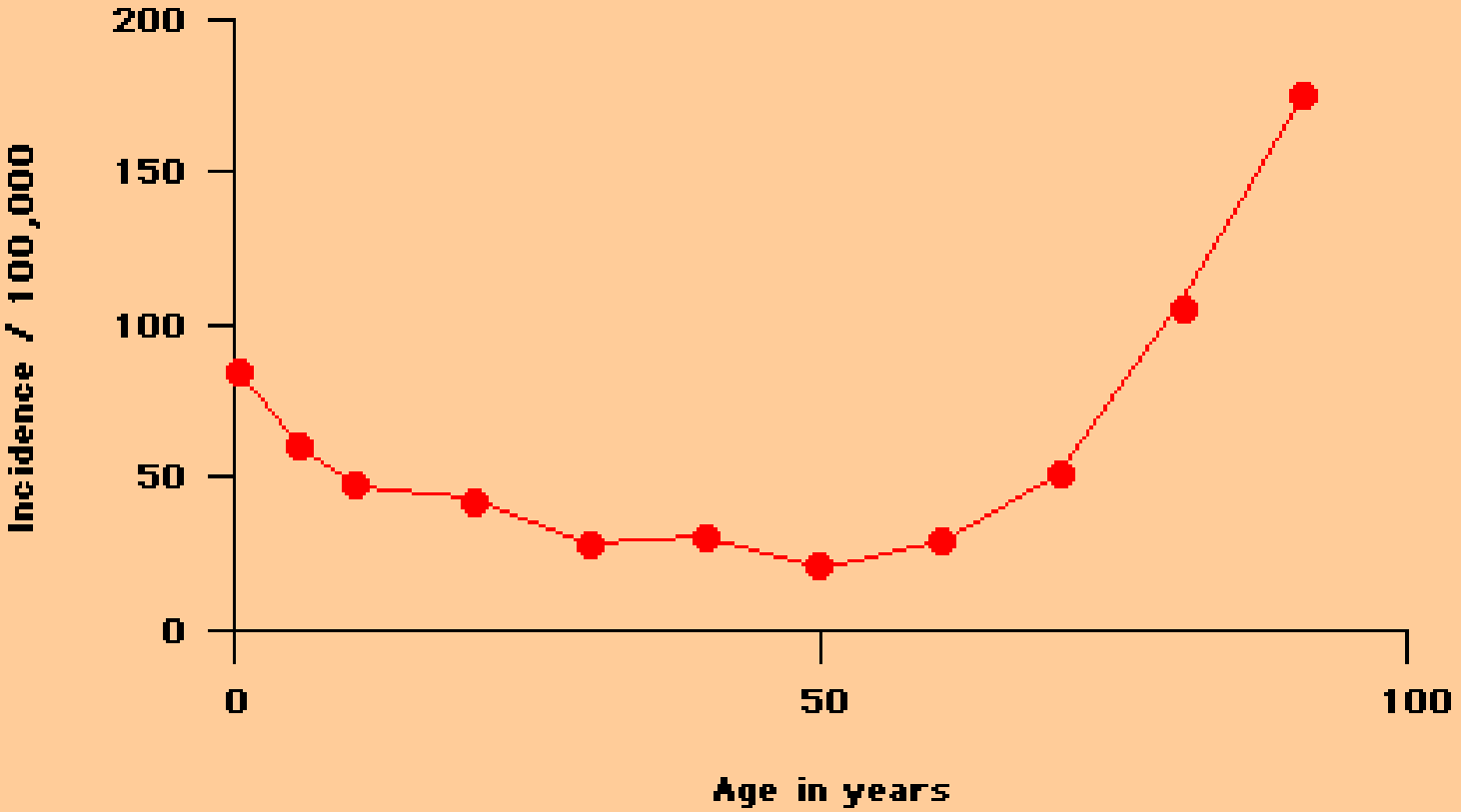
- Congenital disorders.
- Perinatal disorders.
- Mental retardation.
- Cerebral palsy.
- High fevers.
- Head trauma.
- Brain tumors.
- Meningitis and Encephalitis.

# Etiology in Adults:

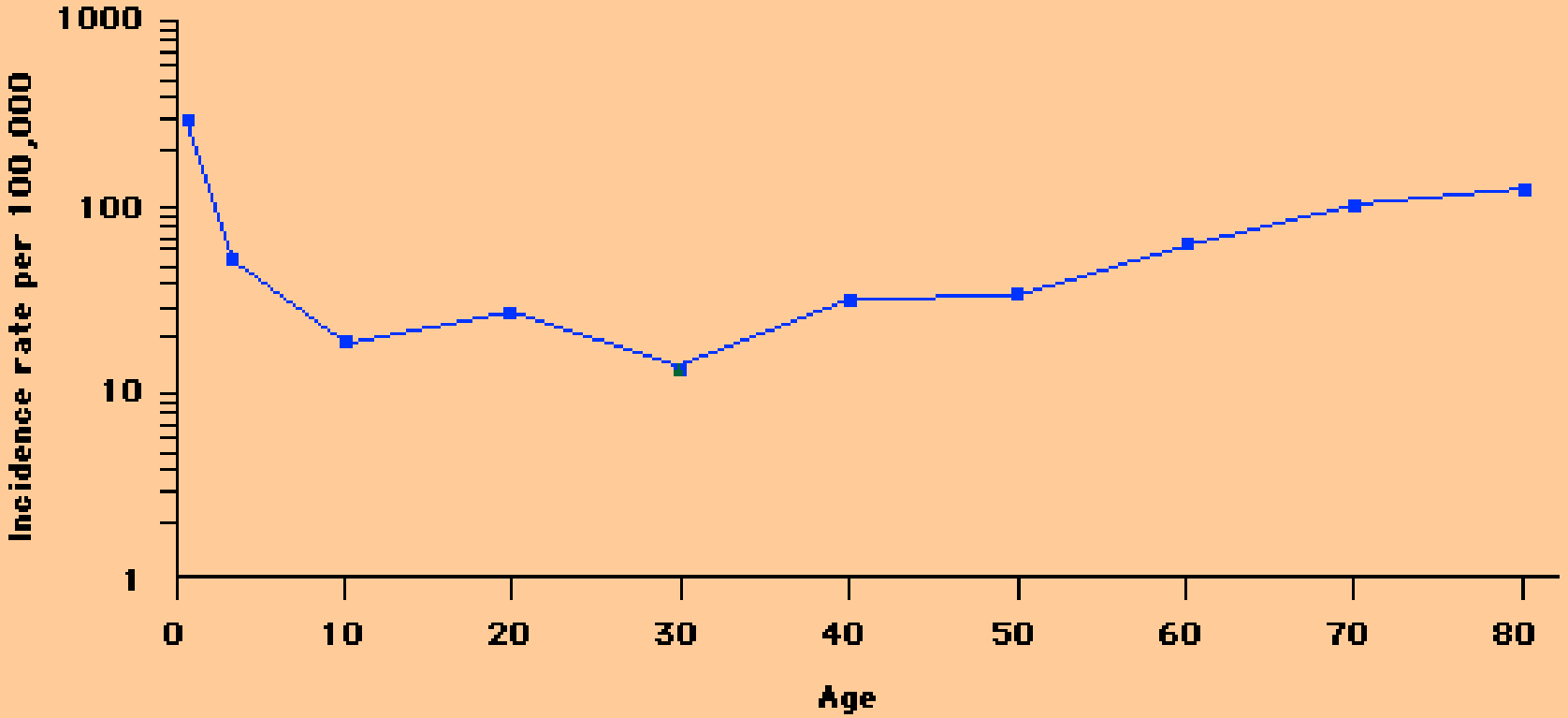
- Head trauma.
- Meningitis and Encephalitis.
- Stroke.
- Brain tumors.
- Alcohol or Heroin use.

# Overall:

- More common in children than in adults.
- Men are 1.0-2.4 times more than women.
- Rates are high under the age of 1 year
- Decline after first decade.
- Low during most of adulthood.
- Secondary increase occurs after age 60 years.




**Age-related incidence of epilepsy** Data from: Hauser, WA, Annegers, JF, Kurland, LT. The incidence of epilepsy and unprovoked seizures in Rochester, Minnesota, 1935-1984. Epilepsia 1993; 34:453.




**Acute symptomatic seizures; rates by age, Rochester, Minnesota, 1975-1984** Data from: Annegers, JF, Hauser, WA, Lee, RJ, Rocca, WA. Incidence of acute symptomatic seizures in Rochester, Minnesota, 1935-1984. Epilepsia 1995; 36:327.

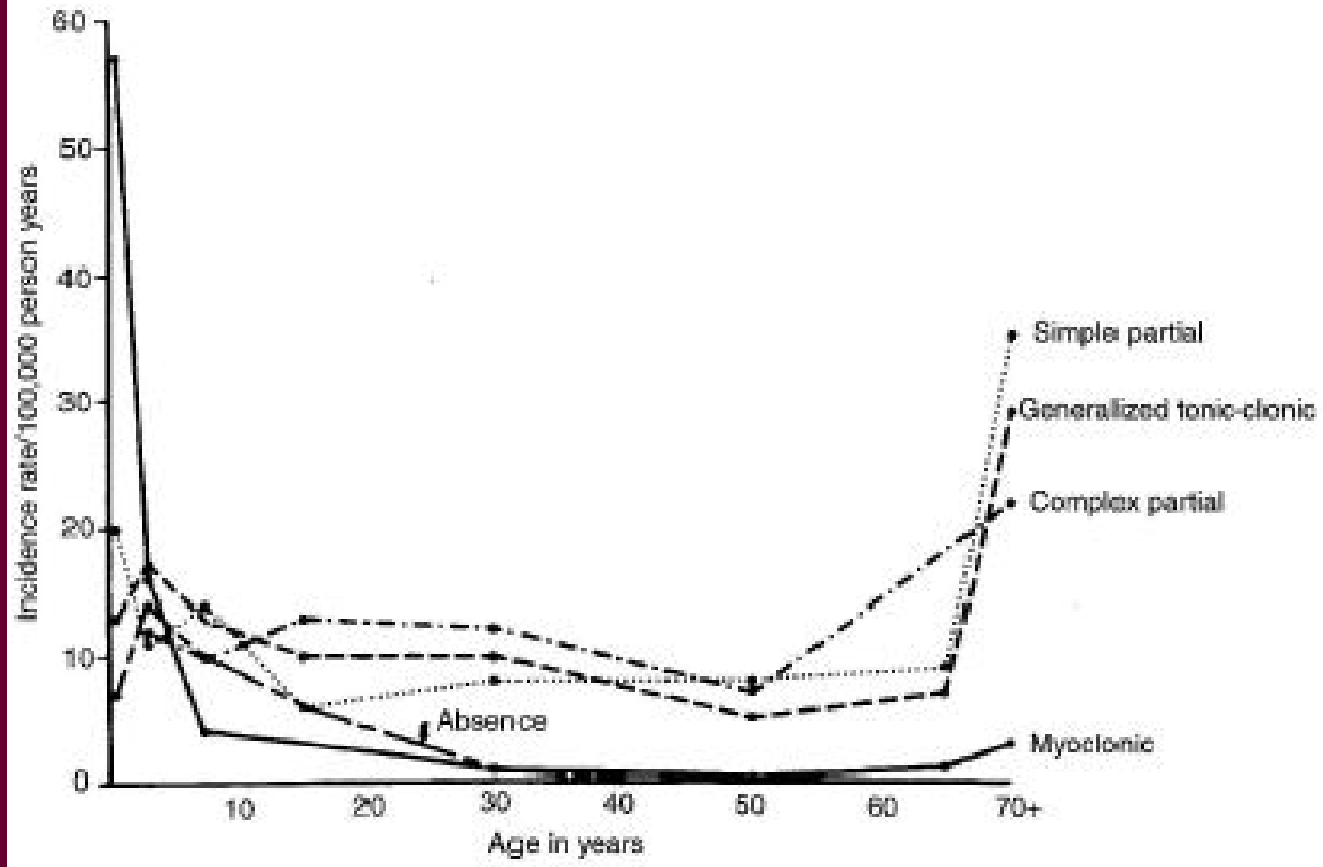



**FIGURE 43.4** Epilepsy. Average annual age-specific incidence rates per 100,000 population by clinical type of seizure (absence, myoclonic, generalized, simple per complex partial). (Reprinted with permission from Kurtzke, J. F. & Kurland, L. T. 1983, "The epidemiology of neurologic disease," in *Clinical Neurology*, vol. 4, eds A. B. Baker & L. H. Baker, Harper & Row, Philadelphia.)

# Simple partial seizures (SPS)

- Seizures are usually stereotyped.
- Visible manifestations, such as jerking of a limb.
- Subjective experiences perceived only by the patient, such as epigastric discomfort, fear, or an unpleasant smell.
- No clouding of consciousness.

# Complex partial seizure (CPS)

- Subjective experiences perceived only by the patient, such as epigastric discomfort, fear, or an unpleasant smell.
- Clouding of consciousness, staring.
- Repetitive motor behaviors, termed automatisms, such as swallowing, chewing, or lip smacking.
- After a CPS, the patient may experience confusion, fatigue, and a throbbing headache.

# Generalized seizures

- In contrast to partial seizures, generalized seizures originate virtually in all regions of the cortex.
- Absence seizures and generalized tonic-clonic seizures are types of generalized seizures.
- Other subtypes of generalized seizures are clonic, myoclonic, tonic, and atonic seizures.

# GTC Seizure

- It begins with an abrupt loss of consciousness, often in association with a scream or shriek. All of the muscles of the arms and legs as well as the chest and back then become stiff. The patient may begin to appear cyanotic during this tonic phase. After approximately one minute, the muscles begin to jerk and twitch for an additional one to two minutes. During this clonic phase the tongue can be bitten, and frothy and bloody sputum may be seen coming out of the mouth. The postictal phase begins once the twitching movements end. The patient is initially in a deep sleep, breathing deeply, and then gradually wakes up, often complaining of a headache.

# Phases of GTC Seizure

- Premonitory signs and symptoms
- Aura phase
- Pretonic phase
- Tonic phase
- Clonic phase
- Postictal phase

# Absence seizure

- Usually occur during childhood and typically last between 5 and 10 seconds. They frequently occur in clusters and may take place dozens or even hundreds of times a day. Absence seizures cause sudden staring with impaired consciousness. If an absence seizure lasts for 10 seconds or more, there may also be eye blinking and lip smacking.

# Clonic seizure

- Cause rhythmical jerking muscle contractions that usually involve the arms, neck, and face.

# Myoclonic seizure

- Consist of sudden, brief muscle contractions that may occur singly or in clusters and that can affect any group of muscles, although typically the arms are affected. Consciousness is usually not impaired.

# Tonic seizure

- Tonic seizures cause sudden muscle stiffening, often associated with impaired consciousness and falling to the ground.

# Atonic seizure

- Atonic seizures (also known as drop seizures or drop attacks) produce the opposite effect of tonic seizures — a sudden loss of control of the muscles, particularly of the legs, that results in collapsing to the ground and possible injuries.

# Outcome of first seizure:

- Risk of seizure recurrence is 27% to 80%.
- Most within 6 months of the first seizure.
- Risk decreases with longer interval from the initial event.
- High rate of recurrence:

  CNS insults, Neonatal period.

Table 1. **Risk Factors for Recurrent Epileptic Seizures**

| |
|---|
| Increased risk |
| Known symptomatic cause |
| Partial seizures |
| Family history of epilepsy |
| Abnormal electroencephalogram (particularly generalized spike-and-slow wave) |
| Abnormal findings on neurologic examination |
| Abnormal imaging findings |
| Decreased risk |
| Idiopathic cause |
| Generalized seizure |
| No family history of epilepsy |
| Normal electroencephalogram |
| Normal findings on neurologic examination |

# Diagnosis:

- Drug History.
- Family History.
- Past Medical History.
- Physical and Neurological Examination.
- Laboratory Screening.
- Routine EEGs.
- Neuroimaging.

Anticholinesterases (organophosphates, physostigmine)
Antidepressants (tricyclic, monocyclic, heterocyclic)
Antihistamines
Antipsychotics (phenothiazines, butyrophenones, clozapine)
β-Adrenergic receptor blockers (propranolol, oxprenolol)
Chemotherapeutics (etoposide, ifosfamide, cisplatinum)
Cyclosporine, FK 506
Hypoglycemic agents (including insulin)
Hypoosmolar parenteral solutions
Isoniazid
Local anesthetics (bupivacaine, lidocaine, procaine, etidocaine)
Methylxanthines (theophylline, aminophylline)
Narcotic analgesics (fentanyl, meperidine, pentazocine, propoxyphene)
Penicillins
Phencyclidine
Sympathomimetics (amphetamines, cocaine, ephedrine, MDMA[1] "ecstasy," phenylpropanolamine, terbutaline)

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**Systemic disorders**

- Hypoglycemia
- Hyponatremia
- Hyperosmolar states
- Hypocalcemia
- Uremia
- Hepatic encephalopathy
- Porphyria
- Drug overdose
- Drug withdrawal
- Global cerebral ischemia
- Hypertensive encephalopathy
- Eclampsia
- Hyperthermia

**Primary neurologic disorders**

- Benign febrile convulsions of childhood
- Idiopathic epilepsy
- Head trauma
- Stroke or vascular malformations
- Mass lesions
- Meningitis or encephalitis
- HIV encephalopathy

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Blood studies

- Fasting glucose
- Serum calcium
- Serum FTA-ABS
- Serum electrolytes
- Complete blood count
- Erythrocyte sedimentation rate
- Renal function studies
- Hepatic function studies

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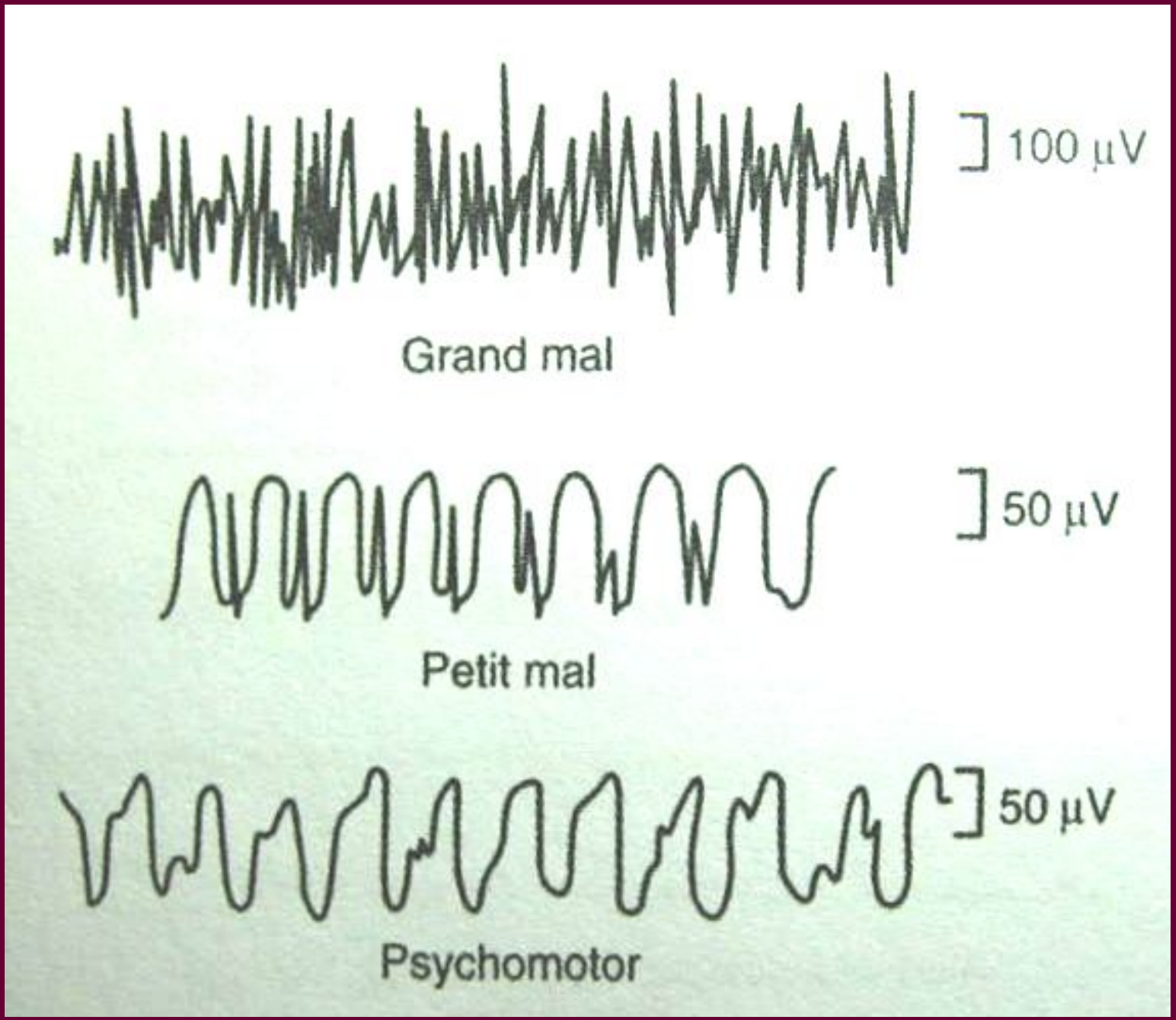
100 μV
Grand mal
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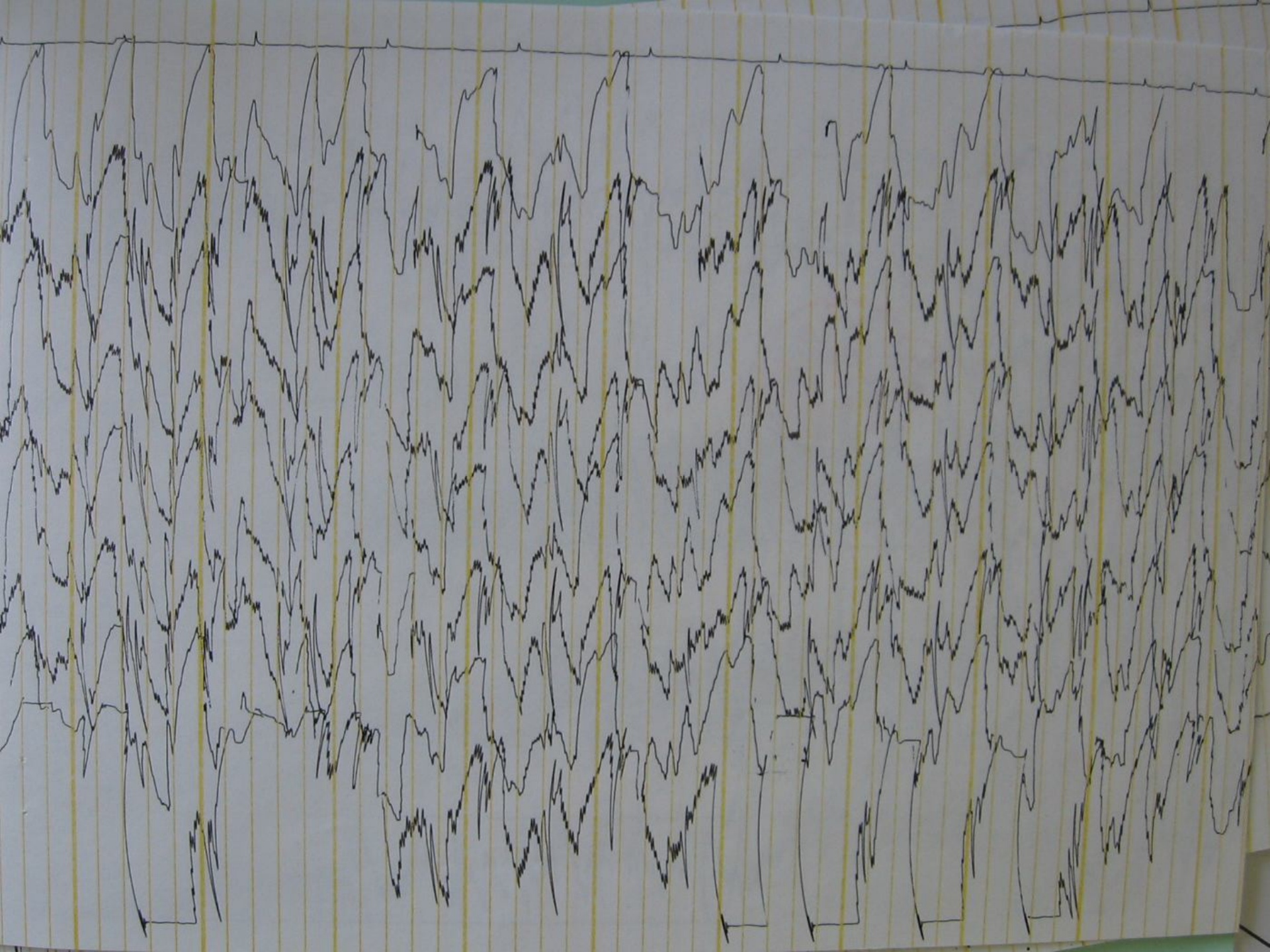
Petit mal
50 μV
Psychomotor



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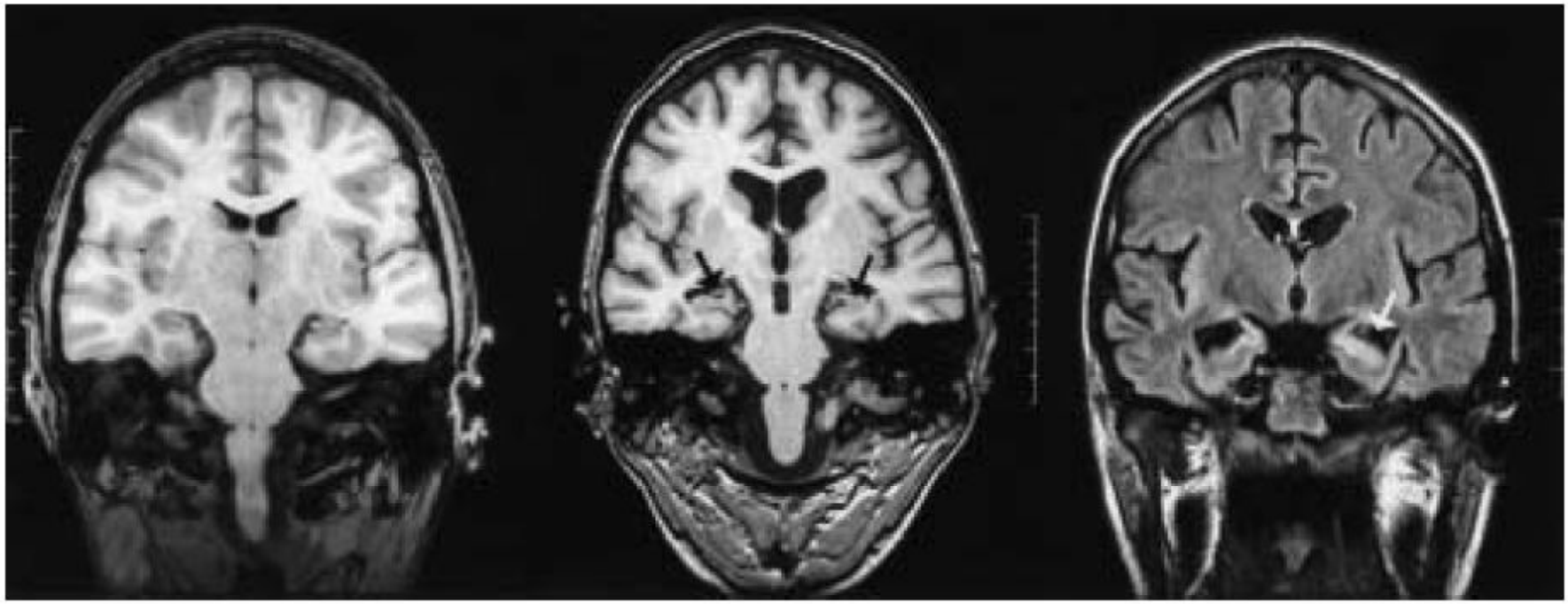
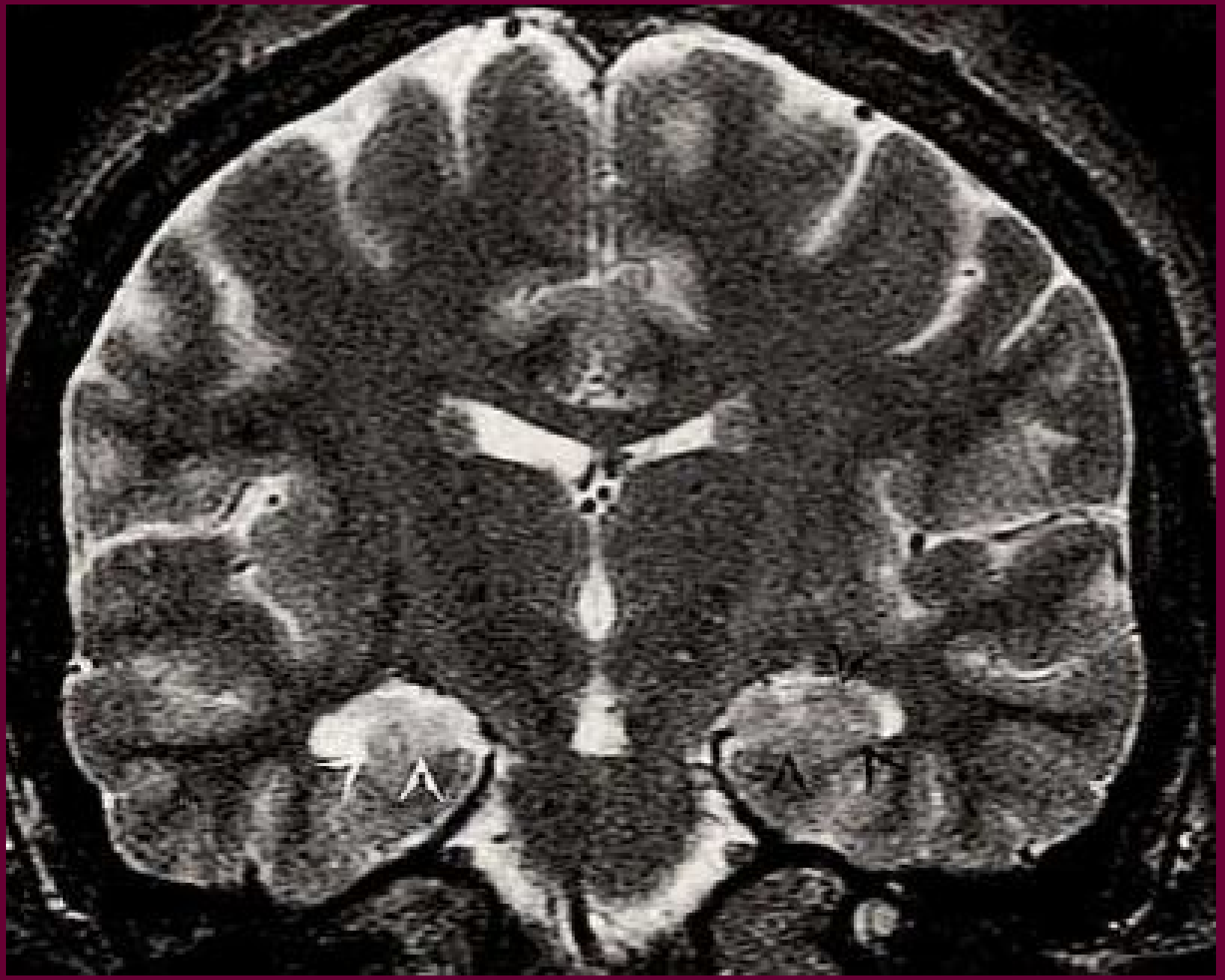
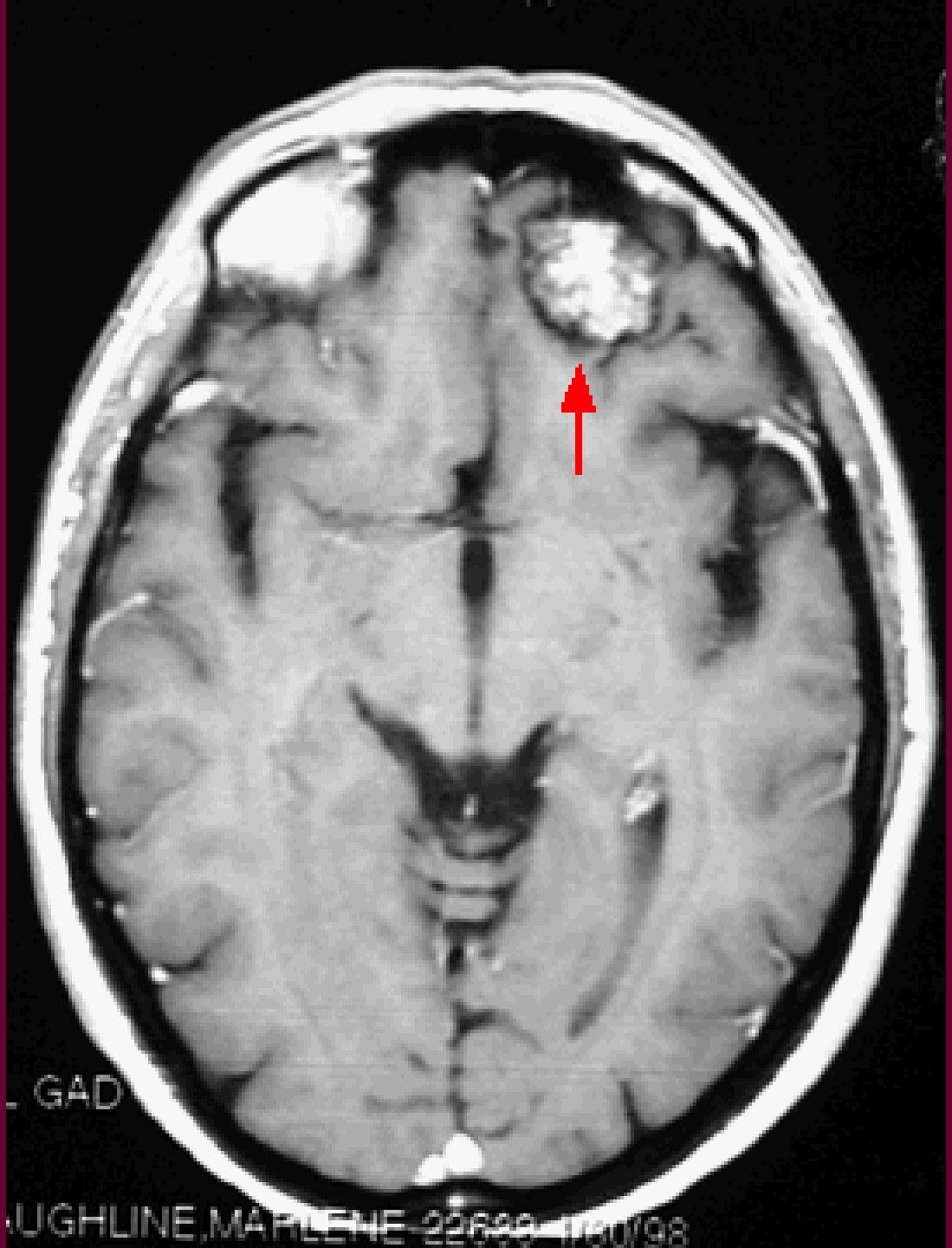


Figure 1. Coronal sections of T1-weighted magnetic resonance images at onset of (left) and 6 weeks after (middle) a prolonged episode of status epilepticus in a 19-year-old man. Note overall brain and hippocampal atrophy (arrows, middle). Fluid-attenuated inversion recovery (FLAIR) imaging 6 weeks after a prolonged episode of status epilepticus reveals evidence of the development of mesial temporal sclerosis (arrow, right). Images are not concordant because they were obtained at different facilities.

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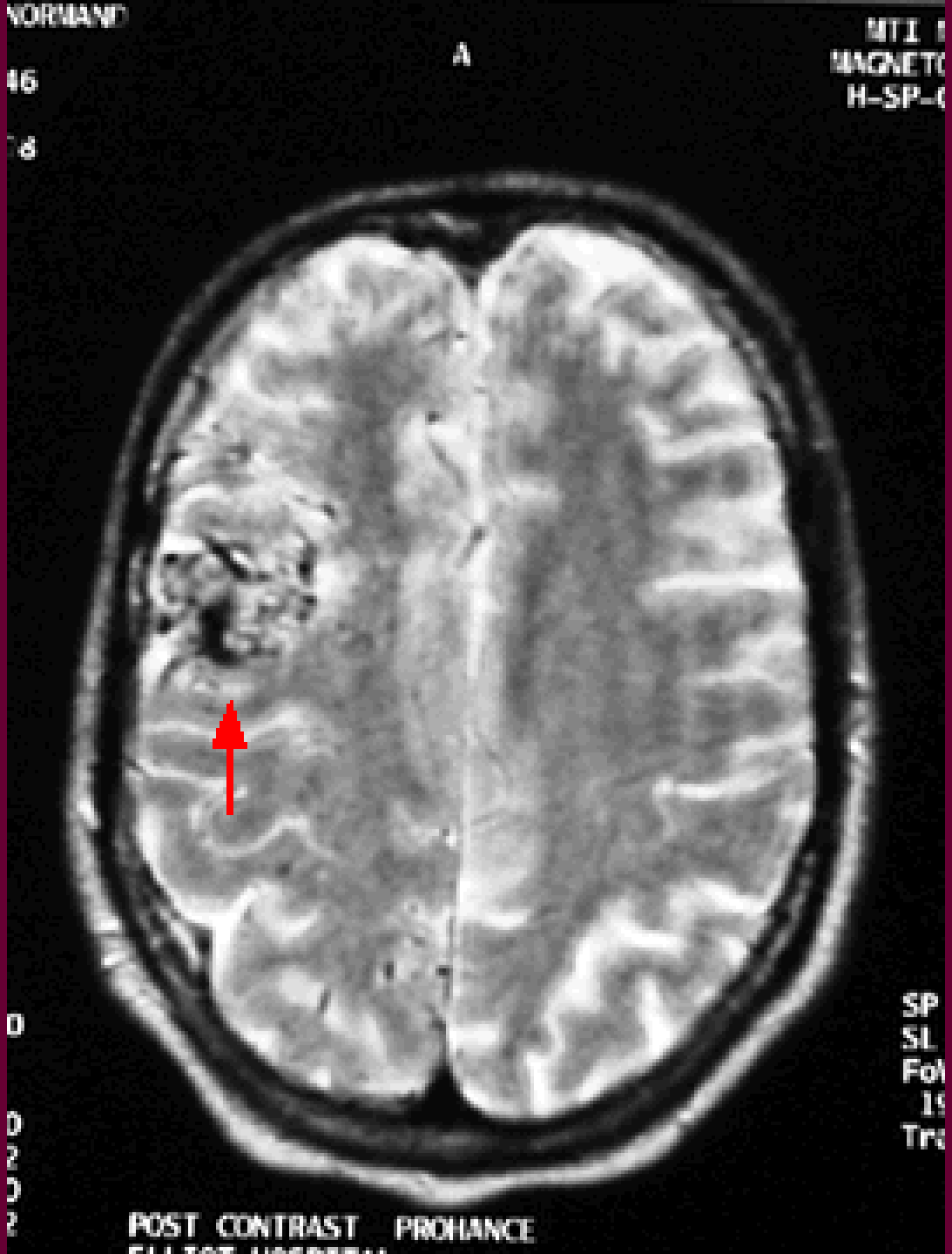
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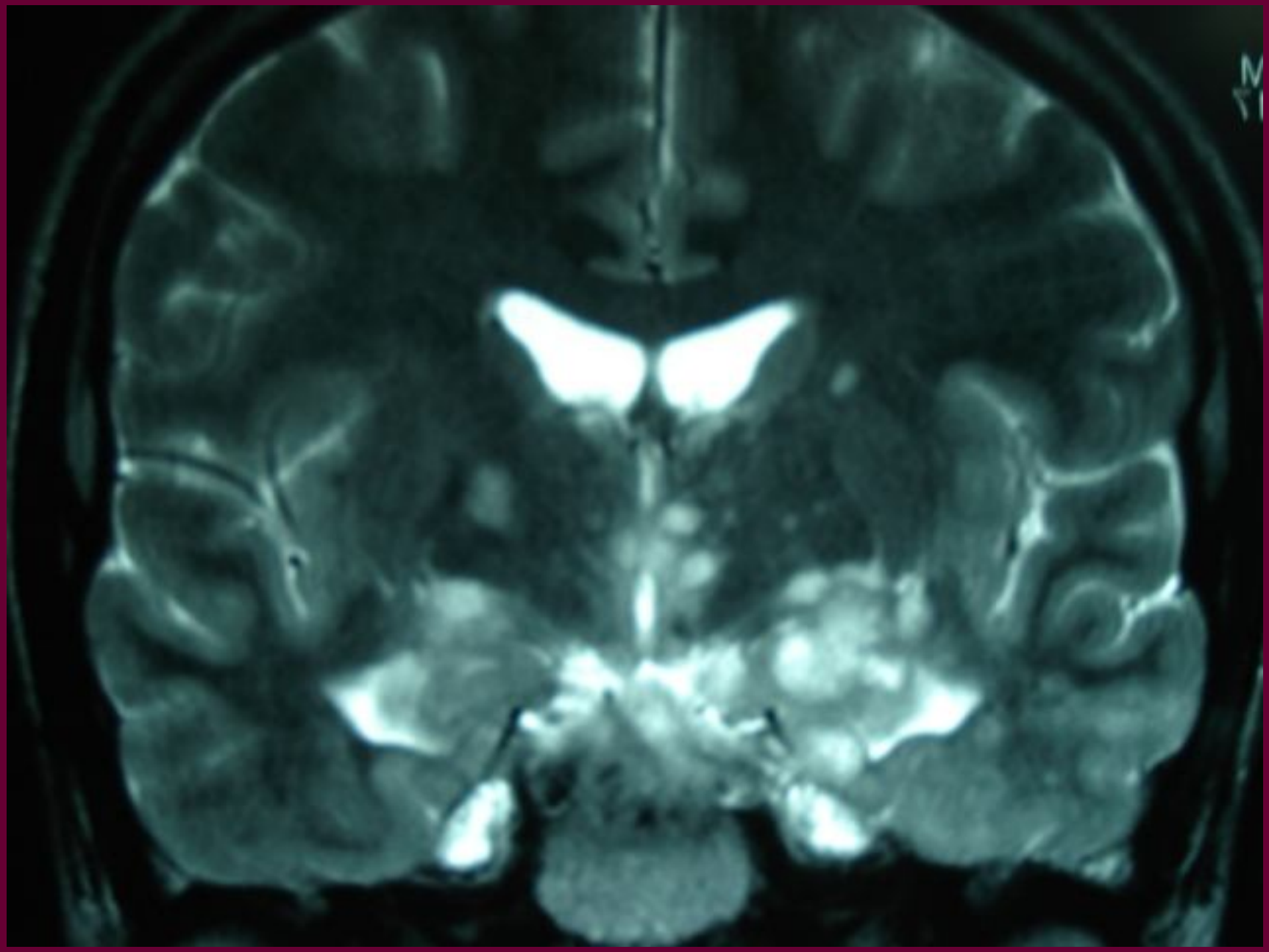

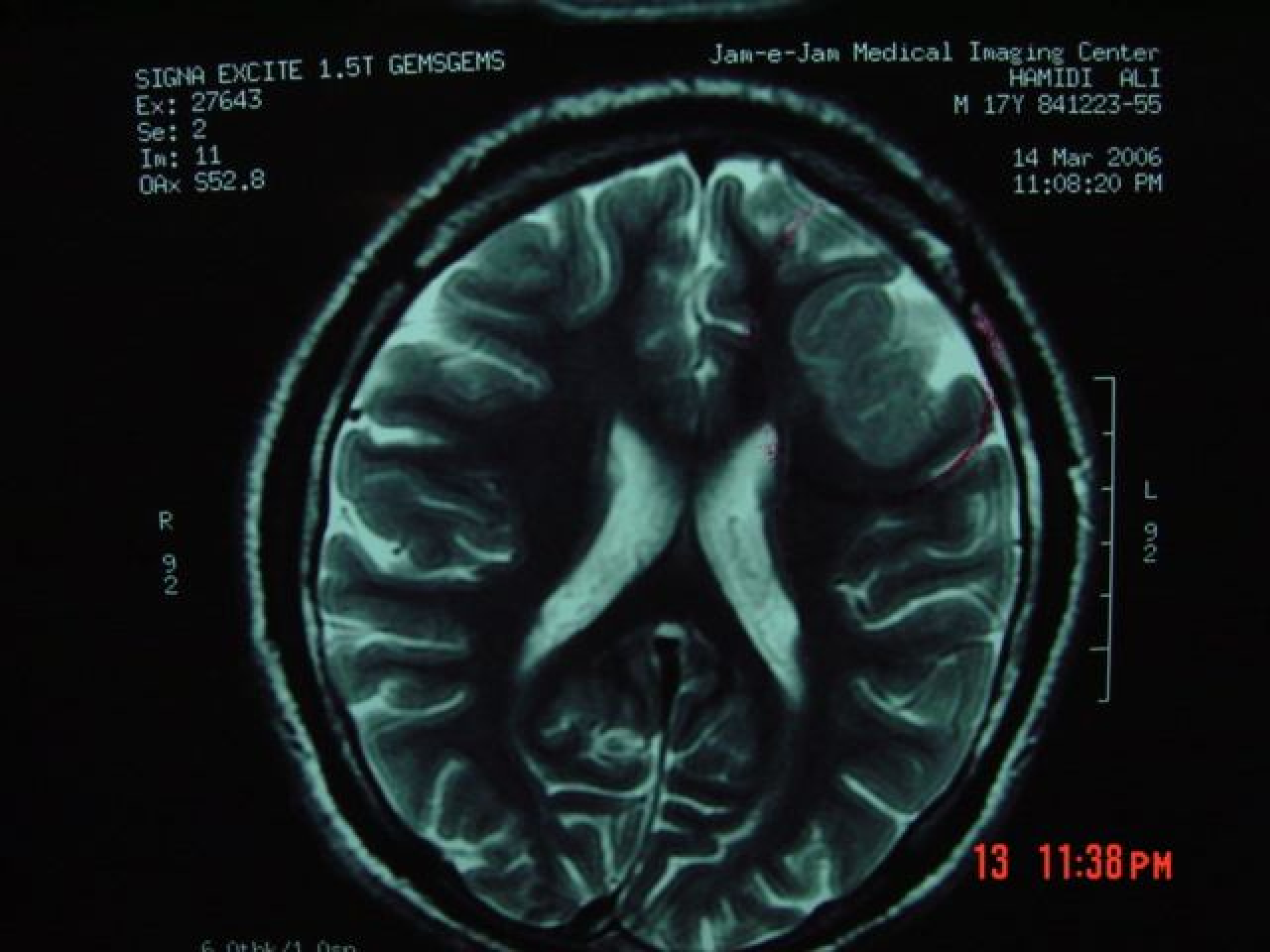
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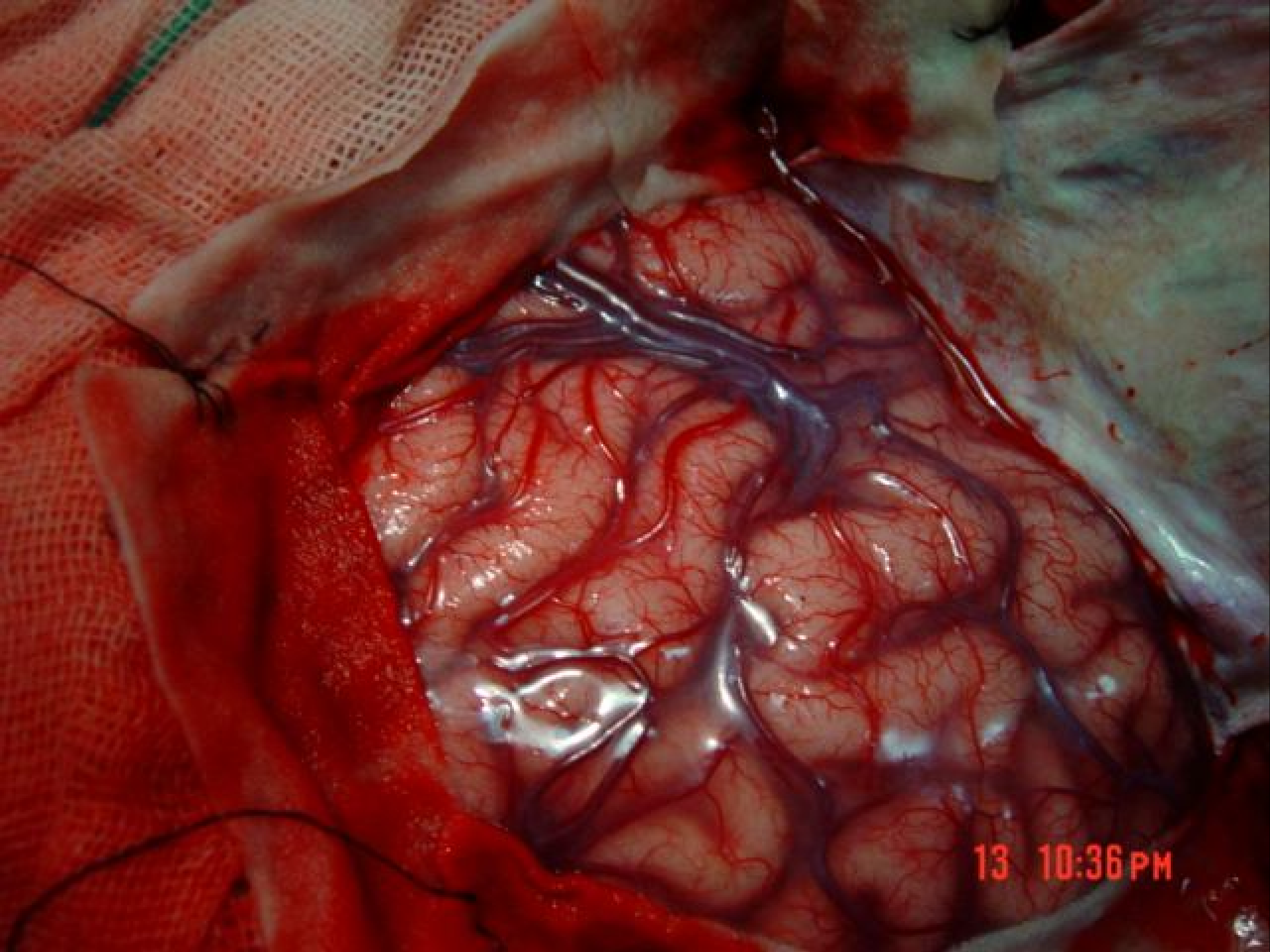
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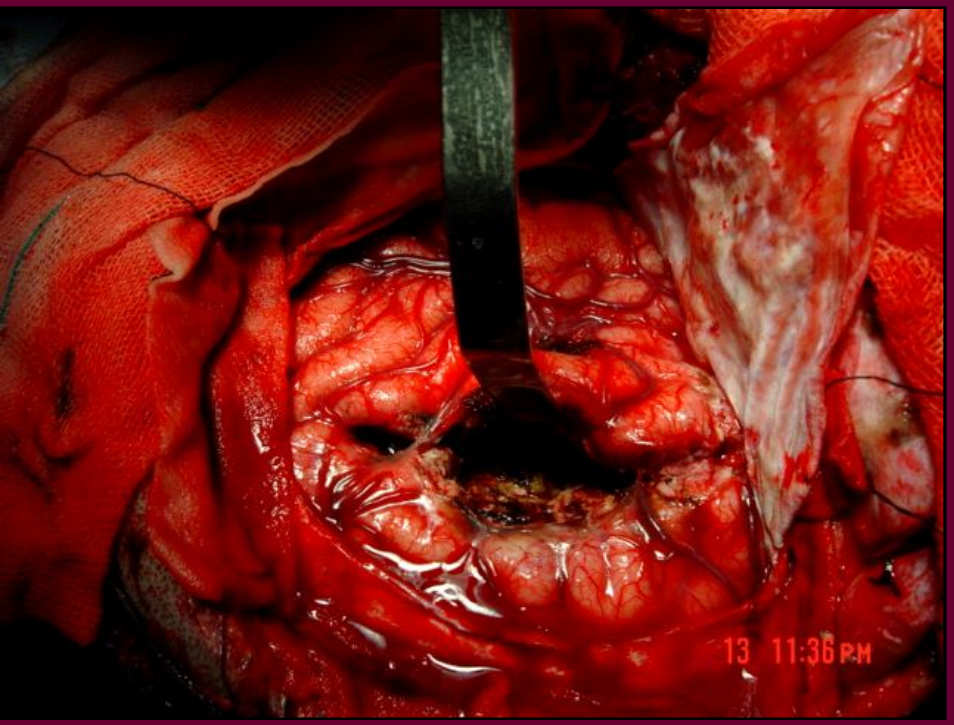
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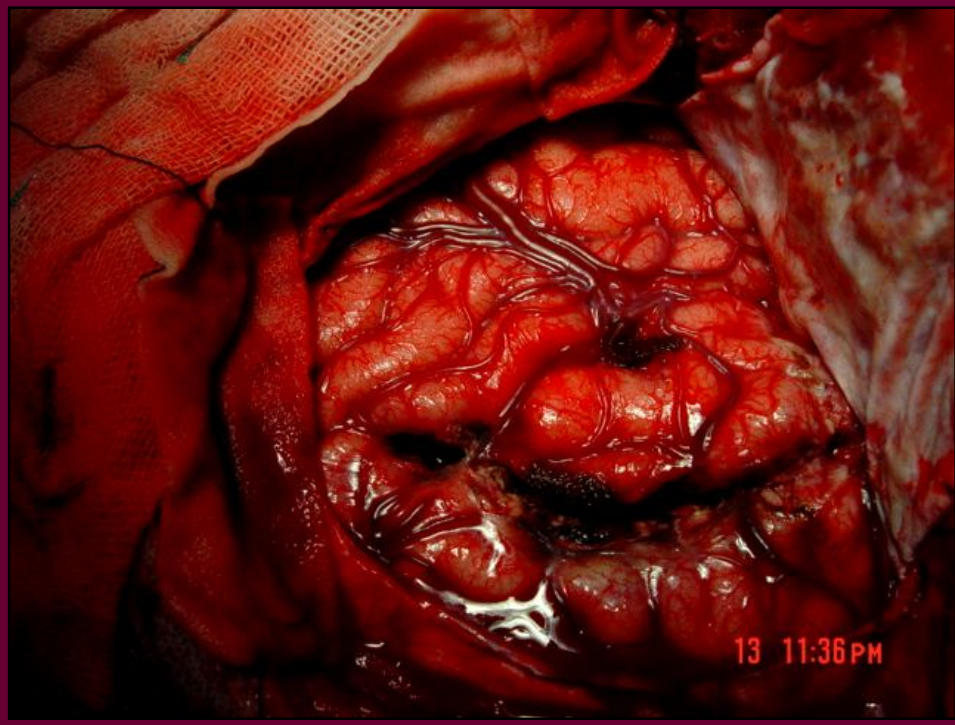
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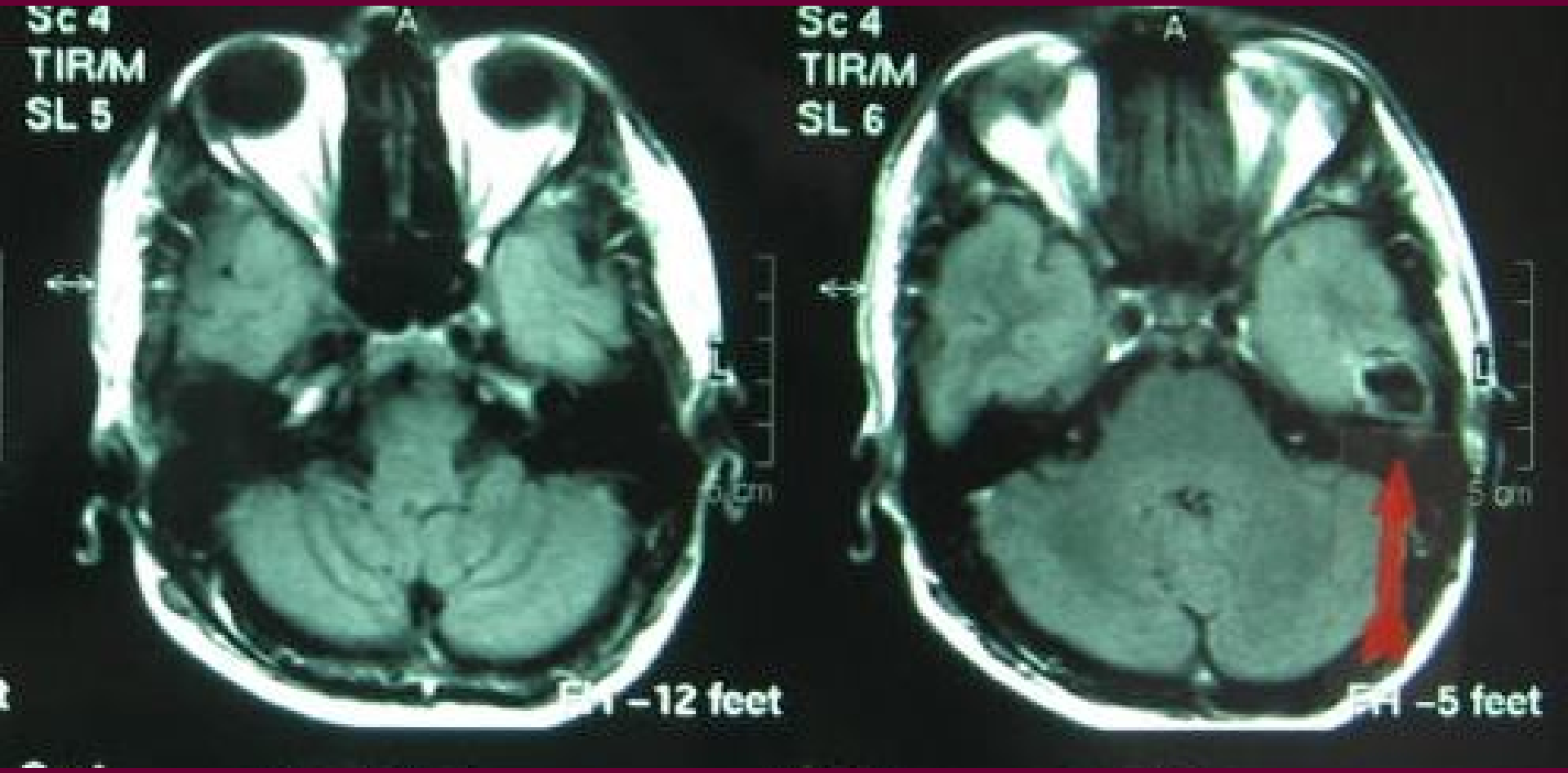
Sc 4
TIR/M
SL 5
A
FH -12 feet
Sc 4
TIR/M
SL 6
A
FH -5 feet

# Seizure is a clinical diagnosis:

- Except : absence seizure that EEG is necessary for definite diagnosis.

# Emergency treatment of seizure

# First Important Step

- Is it a correct suggestion.

# Which possibility

- Seizure
- Pseudoseizure
- Syncope or Faint
- Transient Ischemic Attacks (TIAs)
- Transient Global Amnesia (TGA)
- REM Behavior Disorder (RBD)
- Migraine
- Cataplexy

# How to Differentiate

- Obtain a careful history
- Perform a exact neurological exam

**Table 2.3:** Comparison of absence and complex partial seizures

| *Feature* | *Absence seizure* | *Complex partial seizure* |
|---|---|---|
| Age at onset | Childhood or adolescence | Any age |
| Aura or warning | No | Common |
| Onset | Abrupt | Gradual |
| Duration | Seconds | Up to minutes |
| Automatisms | Simple | More complex |
| Provocation by hyperventilation | Common | Uncommon |
| Termination | Abrupt | Gradual |
| Frequency | Possibly multiple seizures per day | Occasional |
| Postictal phase | No | Confusion, fatigue |
| Electroencephalogram | Generalized spike and wave | Focal epileptic discharges or nonspecific lesions |
| Neuroimaging | Usually normal | May demonstrate focal lesions |

**Table 2.4: Comparison of psychogenic and epileptic seizures**

| *Feature* | *Psychogenic seizure* | *Epileptic seizure* |
|---|---|---|
| Stereotypy of attack | May be variable | Usually stereotyped |
| Duration | May be prolonged | Brief |
| Diurnal variation | Daytime | Nocturnal or daytime |
| Injury | Rare | Can occur with tonic-clonic seizures |
| Tongue biting | Rare | Can occur with tonic-clonic seizures |
| Urinary incontinence | Rare | Common |
| Motor activity | Prolonged, uncoordinated; pelvic thrusting | Automatisms or coordinated tonic-clonic seizures |
| Postictal confusion | Rare | Common |
| Relation to medication changes | Unrelated | Usually related |
| Interictal EEG | Normal | Frequently abnormal |
| Ictal EEG | Normal | Abnormal |
| Presence of secondary gain | Common | Uncommon |
| Psychiatric disturbances | Common | Uncommon |

EEG = electroencephalogram.

Table 2.1: Comparison of clinical features of syncope and seizures

| *Features* | *Syncope* | *Seizure* |
|---|---|---|
| Relation to posture | Common | No |
| Time of day | Diurnal | Diurnal or nocturnal |
| Precipitating factors | Emotion, injury, pain, crowds, heat | Sleep loss, drug/alcohol withdrawal |
| Skin color | Pallor | Cyanosis or normal |
| Aura or premonitory symptoms | Long | Brief |
| Convulsion | Rare | Common |
| Injury | Rare | Common (with convulsive seizures) |
| Urinary incontinence | Rare | Common |
| Postictal confusion | Rare | Common |
| Postictal headache | No | Common |
| Focal neurological signs | No | Occasional |
| Cardiovascular signs | Common (cardiac syncope) | No |
| Abnormal electroencephalogram recording | Rare (may show generalized slowing during the event) | Common |

# Second step

Evaluation of patients for Emergent measures

# Evaluation of patients

- Checking of airway and breathing
- Checking of circulation
- Checking of *Herniation* red flags

# Emergent measures

- Diazepam for active seizure
- Control of status epilepticus
- Administration of phenytoin
- Injection of Ca, Glu and other drugs
- Control of violent behavior

| | *Diazepam* |
|---|---|
| Adult IV dose in mg/kg (range [total dose]) | 0.15–0.25 [10 mg] |
| Pediatric IV dose in mg/kg (range [total dose]) | 0.1–1.0 [10 mg] |
| Pediatric per rectum dose in mg/kg | 0.2–0.5 [20 mg maximum] |
| Maximal administration rate in mg/min | 5.0 |
| Time to stop status in minutes | 13 |
| Effective duration of action in hours | 0.25–0.50 |
| Potential side effects | |
| Depression of consciousness | 10–30 min |
| Respiratory depression | Occasional |
| Hypertension | Infrequent |
| Cardiac arrhythmia | |

# Emergent measures

- Diazepam for active seizure
- Control of status epilepticus
- Administration of phenytoin
- Injection of Ca, Glu and other drugs
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## کدام یك از موارد زیر تعریف عملی تری از استاتوس اپی لپتیکوس (صرع مداوم) است؟

- الف- ۵ دقیقه حمله تشنجی مداوم یا ۱۵ دقیقه حملات تشنجی پی در پی بدون اینکه بین حملات بیمار به طور کامل هوشیاری اش را بدست آورد.
- ب- ۱۵ دقیقه حمله تشنجی مداوم
- ج- ۱۵ دقیقه حملات تشنجی پی در پی بدون در نظر گرفتن اینکه بین حملات بیمار به طور کامل هوشیاری اش را بدست آورد یا نه.
- د- ۳۰ دقیقه حملات تشنجی پی در پی بدون اینکه بین حملات بیمار به طور کامل هوشیاری اش را بدست آورد.

# Definition of status epilepticus

- Diagnose SE by observing continued seizure activity or one aditional seizure at postictal period of previous seizure

## کدامیك از روش های زیر در قدم اول در برخورد با صرع مداوم بکار میروند؟

- الف- باز کردن راه هوایی وکنترل تنفس و فشار خون
- ب- رگ گرفتن و تزریق ۵۰ میلی گرم دکستروز ۵۰% همراه با ۱۰۰ میلی گرم تیامین وریدی
- ج- بررسی آلرژی به داروهای ضد تشنج
- د- تزریق ضد تشنج

# قدم اول در درمان تشنج مداوم کدام است؟

- الف – دیازپام ۲۰ میلی گرم شوت
- ب- فنی توئین ۵۰۰ میلی گرم آهسته طی ۲ ساعت
- ج- فنی توئین ۲۰ میلی گرم بر کیلوگرم شوت
- د- دیازپام ۱۰ میلی گرم در عرض ۲ دقیقه

# در باره فنی توپین کدام گزینه درست است؟

- الف – باید با سرعت کمتر از ۵۰۰ میلی گرم در ساعت تجویز شود.
- ب- باید با سرعت کمتر از ۵۰ میلی گرم در دقیقه تجویز شود.
- د- نباید در داخل سرم نرمال سالین حل شود.
- ه- در صورت نبود راه وریدی باید عضلانی استفاده شود.

## اگر پس از تزریق فنی توپین (۱۵تا۲۰ میلی پار کیلو) همچنان تشنجات ادامه یابند ؟

- الف- باید از فنوباربیتال وریدی استفاده شود.
- ب- باید از دیازپام بصورت دریپ استفاده شود.
- ج- بیمار بیهوش شود.
- د- میتوان مجددا از مقداری فنی توپین وریدی استفاده کرد.

# دوز وریدی فنوباربیتال در صرع مداوم چقدر است؟

- الف- ۱۰ میلی پار کیلو طی ۵۰ دقیقه
- ب- ۲۰ میلی پار کیلو با سرعت کمتر از ۵۰ میلی گرم در ساعت
- ج- ۱۰ میلی پار کیلو با سرعت کمتر از ۵۰ میلی گرم در دقیقه
- د- ۲۰ میلی پار کیلو با سرعت کمتر از ۵۰ میلی گرم در دقیقه
-

**اگر تشنجات آشکار در صرع مداوم با درمان از بین بروند ولی بیمار همچنان در کوما باشد و اختلالات متابولیك ومسمومیت و عفونت CNS نیز رد شده باشند چه باید کرد؟**

- الف- اقدام خاصی لازم نیست.
- ب- باید با نوار مغزی ادامه تشنجات را بررس و درمان کرد.
- ج- باید دوز داروها را کاهش داد.
- د- باید از داروهای ضد تشنج دیگری استفاده کرد.

Table 73.3: A suggested timetable for the treatment of status epilepticus*

| *Time (min)* | *Action* |
|---|---|
| 0–5 | Diagnose status epilepticus by observing continued seizure activity or one additional seizure.<br>Give oxygen by nasal cannula or mask; position patient's head for optimal airway patency; consider any abnormalities as necessary; initiate ECG monitoring.<br>Obtain and record vital signs at onset and periodically thereafter; control any abnormalities as necessary; initiate ECG monitoring.<br>Establish IV access; draw venous blood samples for glucose level, serum chemistries, hematology studies, toxicology screens, and determinations of antiepileptic drug levels.<br>Assess oxygenation with oximetry or periodic arterial blood gas determinations. |
| 6–10 | If hypoglycemia is established or a blood glucose determination is unavailable, administer glucose; in adults, give 100 mg of thiamine first, followed by 50 mL of 50% glucose by direct push into the IV line; in children, the dose of glucose is 2 mL/kg of 25% glucose. |
| 5–20 | Administer either lorazepam, 0.1 mg/kg IV at 2 mg/min, or diazepam, 0.2 mg/kg IV at 5 mg/min. If diazepam is given, it can be repeated if seizures do not stop after 5 minutes; if diazepam is used to stop the status, phenytoin should be administered next to prevent recurrent status. |
| 10–30 | If status persists, administer phenytoin, 15–20 mg/kg IV, no faster than 50 mg/min in adults and 1 mg/kg/min IV in children; monitor ECG and blood pressure during the infusion; phenytoin is incompatible with glucose-containing solutions; the IV line should be purged with normal saline before the phenytoin infusion. Alternatively, fosphenytoin, 20 mg/kg phenytoin equivalents at 150 mg/min in adults or 3 mg/kg/min in children, can be used. |
| 20–40 | If status does not stop after 20 mg/kg of phenytoin or fosphenytoin, give additional doses of 5–10 mg/kg of phenytoin or fosphenytoin to a maximal dose of 30 mg/kg. |
| 40–60 | If status persists, give phenobarbital, 20 mg/kg IV at 50–100 mg/min; when phenobarbital is given after a benzodiazepine, the risk of apnea or hypopnea is great, and assisted ventilation usually is required. If seizures continue, give an additional 5–10 mg/kg of phenobarbital. |
| >60–70 | If status persists, give anesthetic doses of drugs such as midazolam (loading dose of 0.2 mg/kg by slow intravenous bolus, then 0.75–10.00 μg/kg/min), propofol (loading dose of 12 mg/kg IV, followed by 2–10 mg/kg/hr), or pentobarbital (5–15 mg/kg IV bolus over 1 hour, followed by 0.5–3.0 mg/kg/hr); ventilatory assistance and vasopressors are virtually always necessary. Continuous EEG monitoring is indicated throughout therapy, with the primary endpoint being suppression of EEG spikes or a burst-suppression pattern with short intervals between bursts. |

Treatment with anticonvulsants should be instituted immediately (Table 8–6), while the following measures are taken.

Vital signs:
- Blood pressure: exclude hypertensive encephalopathy and shock
- Temperature: exclude hyperthermia
- Pulse: exclude life-threatening cardiac arrhythmia

Draw venous blood for serum glucose, calcium, electrolytes, hepatic and renal function blood studies, complete blood count, erythrocyte sedimentation rate, and toxicology

Insert intravenous line

Administer glucose (50 mL of 50% dextrose) intravenously

Obtain any available history

Rapid physical examination, especially for:
- Signs of trauma
- Signs of meningeal irritation or systemic infection
- Papilledema
- Focal neurologic signs
- Evidence of metastatic, hepatic, or renal disease

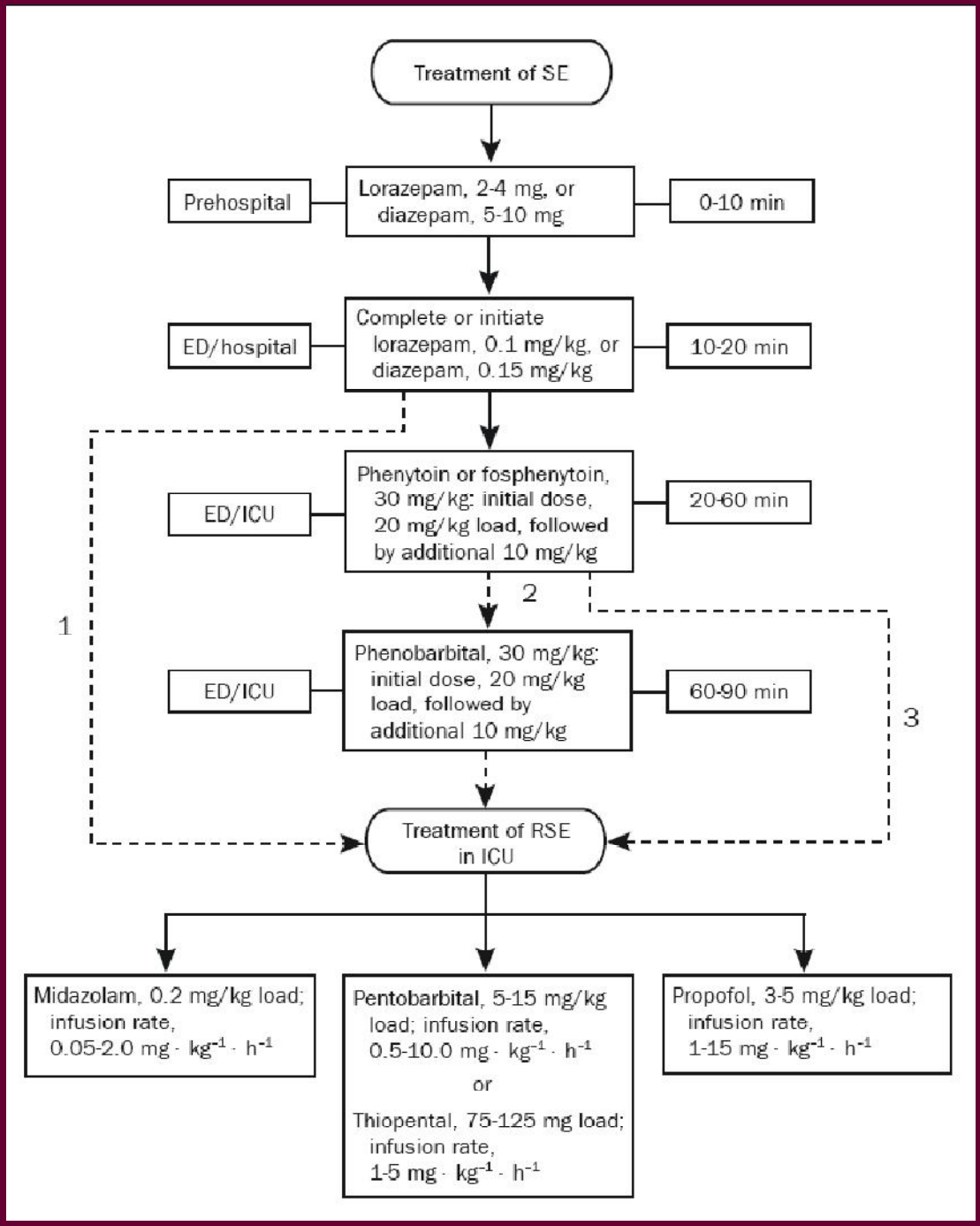
Arterial blood gases

Lumbar puncture, unless the cause of seizures has already been determined or signs of increased intracranial pressure of focal neurologic signs are present

ECG

Calculate serum osmolality: 2 (serum sodium concentration) + serum glucose/20 + serum urea nitrogen/3 (normal range: 270–290)

Urine sample for toxicology, if indicated


Treatment of SE
Prehospital
Lorazepam, 2-4 mg, or diazepam, 5-10 mg
0-10 min
ED/hospital
Complete or initiate lorazepam, 0.1 mg/kg, or diazepam, 0.15 mg/kg
10-20 min
ED/ICU
Phenytoin or fosphenytoin, 30 mg/kg: initial dose, 20 mg/kg load, followed by additional 10 mg/kg
20-60 min
1
2
3
ED/ICU
Phenobarbital, 30 mg/kg: initial dose, 20 mg/kg load, followed by additional 10 mg/kg
60-90 min
Treatment of RSE in ICU
Midazolam, 0.2 mg/kg load; infusion rate, 0.05-2.0 mg · kg-1 · h-1
Pentobarbital, 5-15 mg/kg load; infusion rate, 0.5-10.0 mg · kg-1 · h-1
or
Thiopental, 75-125 mg load; infusion rate, 1-5 mg · kg-1 · h-1
Propofol, 3-5 mg/kg load; infusion rate, 1-15 mg · kg-1 · h-1

# Hospitalization

- Prolonged postictal state
- Incomplete recovery.
- Status epilepticus.
- The presence of a systemic illness that may require treatment.
- Trauma or other neurological diseases.
- Questions regarding compliance.
- Violent behavior.
- For complete evaluation of causes.

# Classification of patients

- First time seizure.
- History of seizure:
  - No previous treatment.
  - History of treatment:
    - regular drug consumption.
    - irregular drug consumption.

# Treatment of first time seizure

- **Symptomatic seizure**:
  1. Trauma
  2. Infection
  3. Metabolic
  4. Hypoxic ischemic
  5. Drug and toxin
- **Non-symptomatic seizure** (single unprovoked seizure).

# Treatment of first time seizure (symptomatic seizure)

- Usually in acute phase of disease or up to six month.
- Occasionally longer period (3-5 years):

1. MRI ABNORMALLITY
2. EEG ABNORMALLITY
3. FND
4. Febrile convulsion
5. Family history
6. Status epilepticus
7. Sever underlying disease
8. Stroke , abscess, tumor and other instances with cortical insult
9. Other possibilities

# Treatment of first time seizure (non-symptomatic seizure)

- **Usually no treatment or up to six month.**
- **Long term treatment:**

- Age <16 or >59
- positive FH
- FC
- Previous trauma and CVA
- Onset with more than one attack
- Onset in night
- Onset with status
- Focal or focal onset
- Absence, partial, myoclonic
- Existence of FND
- Todd's paralysis
- Major developmental anomaly
- Abnormal EEG
- Abnormal MTI or CT-Scan
- Violent behavior
- Low socioeconomic

# Treatment with history of seizure

- **Not previously treated:**

  treatment with adequate drug

- **History of treatment but irregular drug consumption:**

  temporary second drug and recommendation to regular consumption

# Treatment with history of seizure

- **History of treatment and regular drug consumption:**

- Inadequate drug, Inadequate dose, and wrong interval (special food)
- Drug interactions AND consumption of drugs that cause seizure
- Alcohol and elicited drug
- Inadequate sleep, fatigue, stress, computer, hungry
- Recent metabolic and infectious diseases
- Menstruation, puberty, pregnancy, alternation in weight
- Another type of seizure and altered pattern of seizure
- Ultimately no response to one drug

Table 5. **Drugs for Type of Seizure or Epilepsy***

| Disorder and/or clinical scenario | First choice | Second choice |
|---|---|---|
| Complex partial and secondary generalized seizures | Carbamazepine, phenytoin, lamotrigine, levetiracetam, oxcarbazepine, topiramate, zonisamide | Gabapentin, valproic acid, phenobarbital |
| Absence seizures | Lamotrigine, valproic acid | Ethosuximide |
| Primary generalized tonic-clonic seizures | Lamotrigine, valproic acid | Phenobarbital, phenytoin, felbamate |
| Atonic seizures | Clonazepam, valproic acid | Lamotrigine, felbamate |
| Juvenile myoclonic epilepsy | Lamotrigine, valproic acid | Topiramate, zonisamide |
| Lennox-Gastaut syndrome | Lamotrigine, felbamate, valproic acid | Topiramate, zonisamide, phenobarbital |
| 14-year-old girl with juvenile myoclonic epilepsy | Lamotrigine | Valproic acid |
| 35-year-old professional with partial seizures | Carbamazepine, levetiracetam, lamotrigine, oxcarbazepine, zonisamide | Topiramate, phenytoin, valproic acid, phenobarbital |
| 65-year-old with a previous stroke and residual partial seizures, taking multiple medications other than antiepileptic drugs | Levetiracetam, topiramate, lamotrigine, zonisamide | Carbamazepine, gabapentin, phenobarbital, phenytoin, valproic acid |

# Seizure in pregnant women

- New onset seizure
- Eclampsia
- Previous seizure
- Drug considerations

Table 1. **Common Complications of Pregnancy That Occur at an Increased Rate in Women With Epilepsy**

| Pregnancy | Labor and delivery |
|---|---|
| Hyperemesis gravidarum | Premature labor |
| Vaginal hemorrhage | Cesarean section |
| Preeclampsia | Postpartum hemorrhage |
| Eclampsia | |
| Vitamin D deficiency | |
| Vitamin K deficiency | |
| Megaloblastic anemia (decreased folate) | |

Table 2. **Management of Pregnant Women With Epilepsy***

Pre-conception
- Consider medication reduction or discontinuation
- Establish lowest effective dose of medicine
- If valproic acid is the drug of choice, split dosing to 3 or 4 times a day
- Obtain baseline free and total drug levels
- Counsel patient about risk of seizures, medicines, and need for additional tests
- Refer patient for genetic counseling
- Initiate folate supplement: prenatal vitamin with 1 mg of folic acid and an additional 1-mg folic acid tablet

During pregnancy
- Encourage regular visits and counseling
- Suggest patient registers with AED pregnancy registry: 1-888-233-2334
- Encourage avoidance of sleep deprivation
- Encourage AED compliance
- Monitor free and total AED levels, and adjust as needed
- Have patient continue taking folate and prenatal vitamins
- Administer vitamin K, 10 mg/d in last month
- Perform cesarean section if neural tube defect is present

Delivery
- Ensure administration of AED(s)
- Administer vitamin K to neonate

Postpartum
- Follow AED levels closely; reduce dose as needed
- Encourage avoidance of sleep deprivation
- Advise on breast-feeding
- Discuss childcare concerns

Table 3. **Recommendations for Examinations/Vitamins Before and During Pregnancy in Women With Epilepsy***

| Week of pregnancy | Examinations and vitamin initiations |
|---|---|
| Pre-conception | Folic acid initiation |
| 6-10 | AED levels, free and total |
| 16 | AED levels, free and total<br>Maternal serum α-fetoprotein<br>Amniotic α-fetoprotein for exposure to valproate, carbamazepine |
| 18-19 | High-level ultrasonography for neural tube defects |
| 22-24 | Ultrasonography for heart anomalies and cleft defects<br>AED levels, free and total |
| 34-36 | Vitamin K initiation<br>AED levels, free and total |

Table 4. **Amount of Antiepileptic Drug Present in Breast Milk**

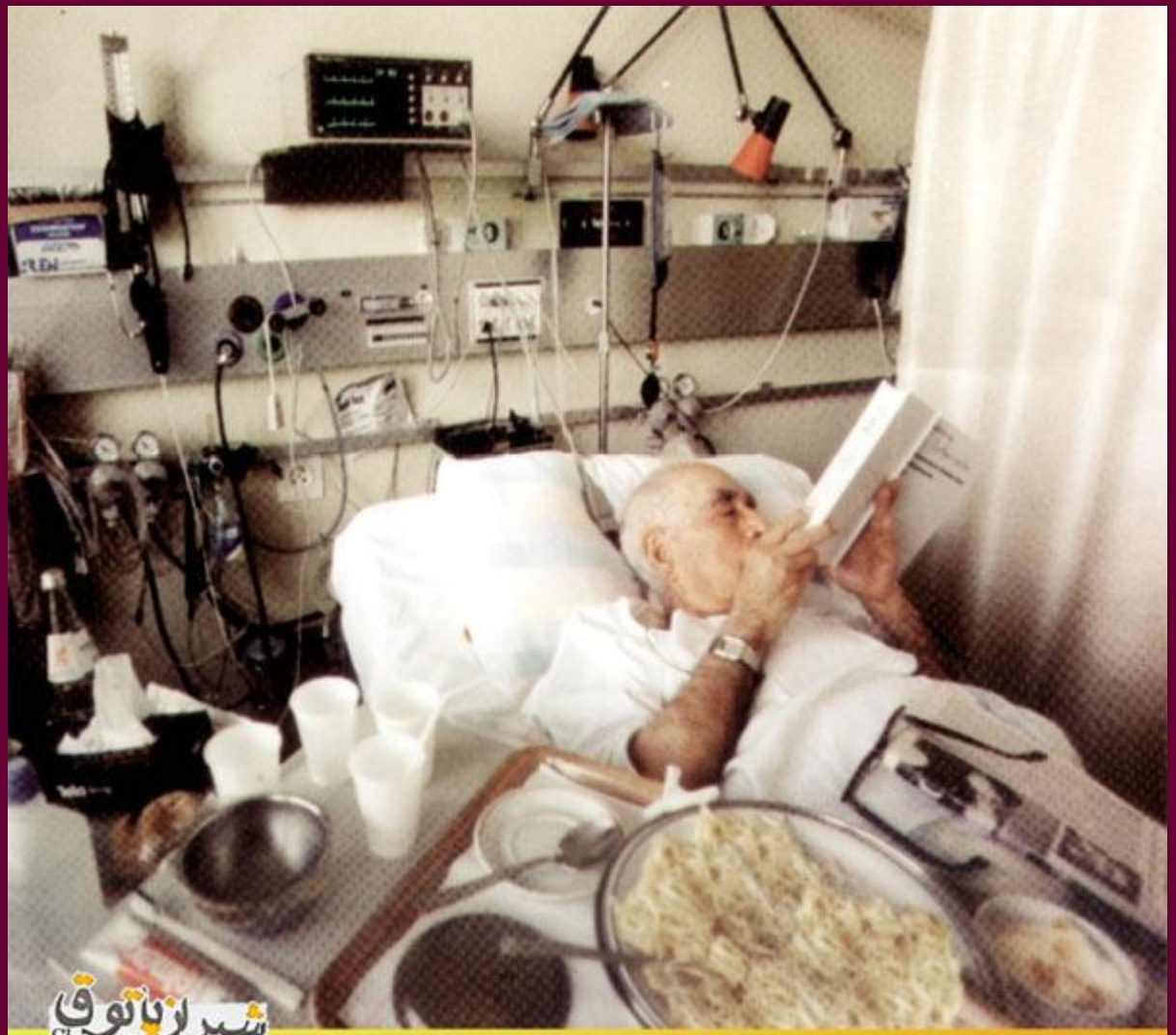
| Antiepileptic drug | Milk to plasma drug concentration (%) |
|---|---|
| Valproic acid | 5 |
| Phenytoin | 18 |
| Phenobarbital | 36 |
| Carbamazepine | 40 |
| Oxcarbazepine | 50 |
| Lamotrigine | 60 |
| Primidone | 70 |
| Gabapentin | 70 |
| Ethosuximide | 90 |
| Topiramate | 86 |
| Levetiracetam | Unknown* |
| Zonisamide | Unknown |
| Tiagabine | Unknown† |

*Although not studied, concentration is expected to be high because of low protein binding.

†Although not studied, concentration is expected to be low because of high protein binding.

# Unsafe drugs:

- Zonsamide
- Lamotrigine
- Oxcarbazepine





## تصویری از آخرین لحظات حیات پرفسور حسابی

شام در کنار تخت استاد سرد شده است. ظاهراً دیگر نیازی به خوردن غذا نیست. پزشکان و مسوولان بیمارستان دانشگاه به این نتیجه رسیده‌اند که معالجه روی قلب استاد دیگر اثری ندارد.

لذا آنژیوکت تزریق چند دارو برای ادامه تپش قلب از رگ دست راست و آنژیوکت تزریق مسکن درد از دست چپ ایشان را خارج و حتی ماسک تامین اکسیژن که دیگر ریه‌ها قادر به تامین آن نبود را برداشته‌اند و تنها سنسورهای تپش قلب روشن است. شگفت اینکه در چنین حالتی در کمال حیرت پزشکان و متخصصین بیمارستان کانتونال دانشگاه ژنو، پروفسور حسابی در آخرین لحظات حیات به چیزی جز مطالعه و افزایش دانش خویش نمی‌اندیشد.

این تصویر منحصر به فرد را یکی از کارکنان خود بیمارستان به عنوان یک تصویر تکان‌دهنده و تاثیرگذار ثبت کرده است.