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MED437
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Epilepsy

Objectives:

- Define Epilepsy
- Etiopathology of Epilepsy
- Types of Epilepsy
- Role of Genetic in Epilepsy
- Clinical Features
- Role of Electrophysiological tests in the diagnosis of Epilepsy

Done by:

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- Special thanks for **Saif AlMeshari**

Colour index:
- Important
- Numbers
- Extra

وَأَن لَّيْسَ لِلْإِنسَانِ إِلَّا مَا سَعَىٰ

Definition of seizure and Epilepsy

Seizures

- Clinical manifestation of synchronised electrical discharges of neurons.
- Seizures are symptoms of a disturbance in brain function, which can be due to epilepsy or other causes.
- A seizure is a sudden surge in electrical activity in the brain that causes an alteration in sensation, behavior, or consciousness.

Epilepsy

- ➢ Present when 2 or more unprovoked seizures occur at an interval greater than 24 hours apart.
- ➢ Sudden recurrent episodes of sensory disturbance.
- ➢ Loss of consciousness, or convulsions.
- ➢ Associated with abnormal electrical activity in the brain.
- ➢ Abnormal, excessive electrical discharge of a group of neurons within the brain.

When a person has recurrent (2 or more), unprovoked seizures → " epileptic ".

Hence seizures can be a symptom of epilepsy .

Provoked seizures

Seizures induced by somatic disorders originating outside the brain.
E.g. fever, infection, syncope, head trauma, hypoxia, toxins, cardiac arrhythmias.

Classification of seizure

Partial or focal seizures

Simple partial seizures
"Jacksonian seizures"
Awareness not impaired

Complex partial seizures
Awareness impaired/lost

Parietal seizures secondarily generalizing

Generalized seizures

Absence (most common)
"Petit Mal epileptic seizure"
- ➢ Typical
- ➢ Atypical

Tonic-clonic
"Grand Mal epileptic seizure"

Myoclonic

Clonic
Jerky movement

Atonic
Hypotonic - flaccid

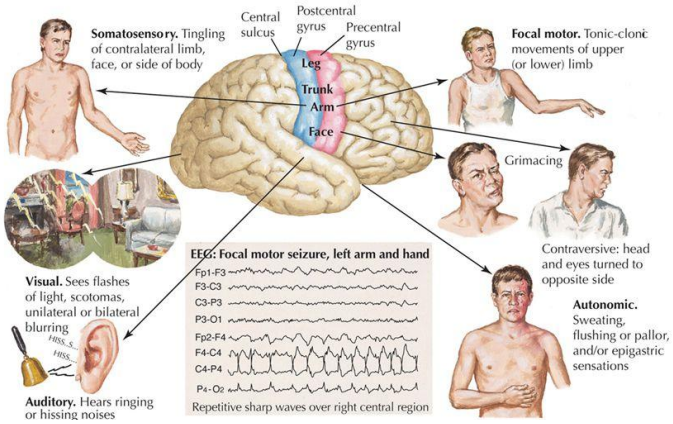
Tonic
↑ muscle tone

Partial or focal seizures

Onset (start) is limited to part of the cerebral hemisphere

Simple partial seizures
"Jacksonian seizures"
Awareness not impaired

manifest motor, somatosensory, and psychomotor symptoms without impairment of consciousness



➢ Partial psychomotor (**temporal lobe**) seizure

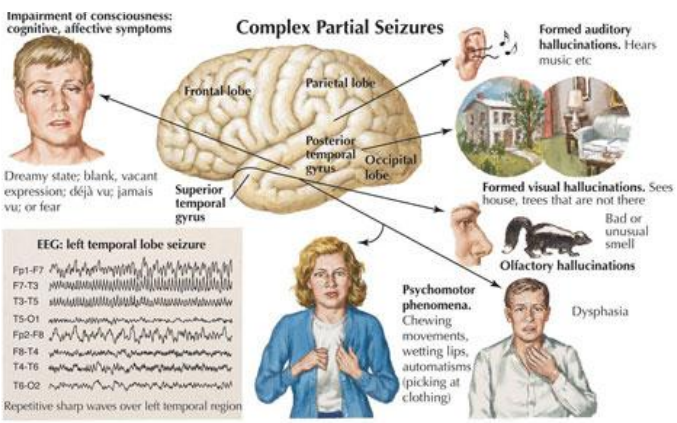
- Epileptic seizures which originate in the temporal lobe of the brain.
- The seizures involve **sensory changes**, for example smelling an unusual odour that is not there, and disturbance of memory."amnesia"
- Visual , auditory , olfactory or visceral **hallucinations**, déjà vu (**over familiarity**)
- The most common cause is **mesial temporal sclerosis.** (Sclerosis of the hippocampus)

➢ Jacksonian epilepsy

Focal motor seizures begin in motor areas of cerebral cortex, usually begins with twitching of the thumb or finger, toe or the angle of the mouth. "Ascend marching"

Complex partial seizures
Awareness impaired/lost

manifest impairment of consciousness with or without simple partial symptoms
(twitching of the thumb and fingers "")



Generalized seizures

- Involve the cerebral cortex diffusely (whole of it) from the beginning.
- Manifest a loss of consciousness
- Convulsive or non-convulsive.
- The onset of a seizures: Small group of abnormal neurons undergo:
  1. Prolonged depolarizations
  2. Rapid firing of repeated action potentials
- Spread to adjacent neurons or neurons with which they are connected into the process.
- Simple partial seizures can progress to complex partial seizures, and complex partial seizures can secondarily become generalized. (if invade the thalamus).
- Seizures affect all ages. Most cases of epilepsy are identified in childhood, and several seizure types are particular to children.
- Generalized epilepsy is abnormal cerebral activity an all the cortex and usually there's involvement of the thalamus.

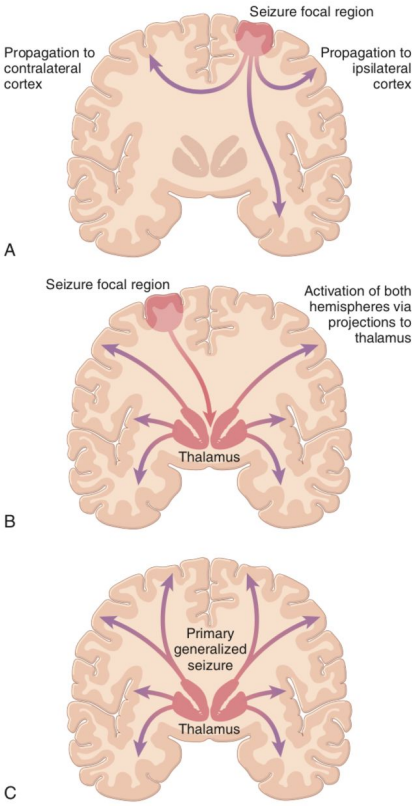
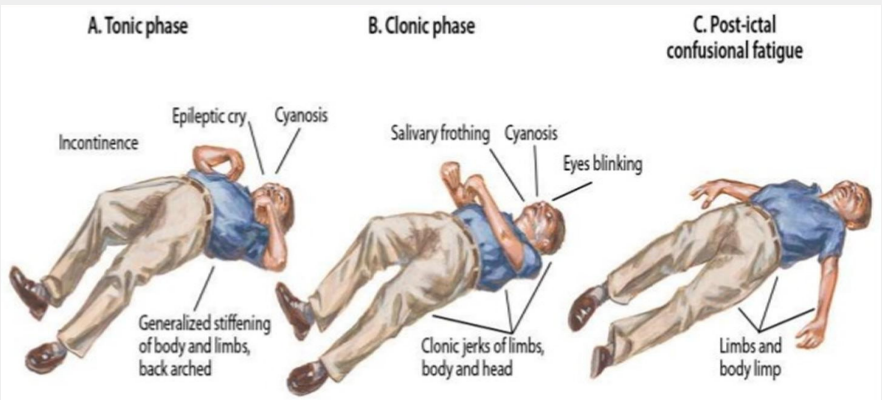


Figure 60-5. A, Propagation of seizures from focal regions of the cortex can occur through fibers in the same cerebral hemisphere or fibers that connect to the contralateral cortex. **B,** Secondary generalization of a focal seizure can sometimes occur by spread to subcortical areas through projections to the thalamus, resulting in activation of both hemispheres. **C,** Primary generalized seizure spreads rapidly and simultaneously to both cerebral hemispheres through interconnections between the thalamus and cortex.

A clinical seizure occurs when the electrical discharges of a large number of cells become abnormally linked together, creating a storm of electrical activity in the brain.

Seizures may then spread to involve adjacent areas of the brain or through established anatomic pathways to other distant areas.



Generalized seizures

★ Very important

Tonic-clonic
"Grand Mal epileptic seizure"
convulsive

Very important Q: what are the phases of grand mal seizure?

- **+/- Aura** (abnormal sensation sensed by the patient himself)

(peculiar sensation or dizziness aware sign; then sudden onset of seizure with loss of consciousness).

- **Tonic phase**

Rigid muscle contraction in which clenched jaw and hands; eyes open with pupils dilated; lasts 30 to 60 seconds. will cause cyanosis

- **Clonic phase**

Rhythmic, jerky contraction and relaxation of all muscles in with incontinence and frothing at the lips; may bite tongue or cheek, lasts several minutes.

- **Postictal state**

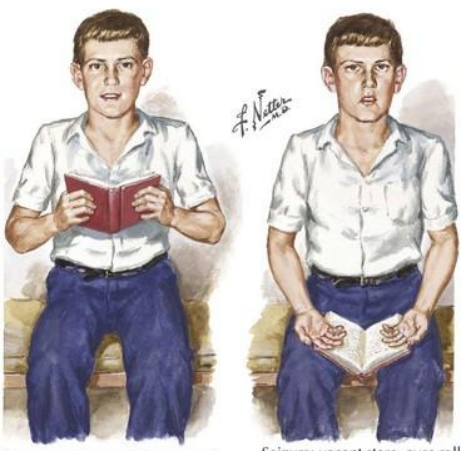
Sleeping or dazed for up to several hours.

Absence
"Petit Mal epileptic seizure"
Non-convulsive

A. Loss of contact with environment for 5 to 30 seconds.

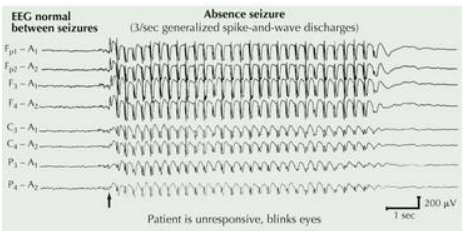
B. Appears to be day dreaming or may roll eyes, nod head, move hands, or smack lips.

C. Resumes activity and is not aware of seizure.



Between seizures patient normal

Seizure: vacant stare, eyes roll upward, eyelids flutter (3/sec), cessation of activity, lack of response



Clinical manifestations of a seizure

The clinical manifestations of a seizure reflect the area of the brain from which the seizure begins (i.e., seizure focus) and the spread of the electrical discharge.

Clinical manifestations accompanying a seizure are numerous and varied, including:
Generally

1. indescribable bodily sensations
2. "pins and needles" sensations
3. smells or sounds
4. fear or depression
5. hallucinations
6. momentary jerks or head nods
7. staring with loss of awareness
8. Convulsions → i.e., involuntary muscle contractions lasting seconds to minutes.

★ The manifestation depends on the site of seizure.

Aetiology of seizures

Epileptic

- Idiopathic (70-80%)
- Cerebral tumor
- Neurodegenerative disorders
- Secondary to:

1. Cerebral damage, e.g. congenital infections, intraventricular hemorrhage
2. Cerebral dysgenesis/malformation, e.g. hydrocephalus

Non-Epileptic

- Febrile convulsions
- Metabolic:

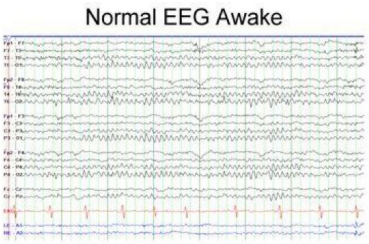
-Hypoglycemia
-HypoCa, HypoMg, HyperNa, HypoNa

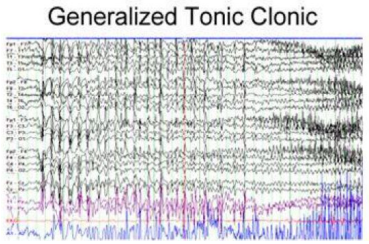
- Head trauma
- Meningitis
- Encephalitis
- Poisons/toxins

Electroencephalogram (EEG)

- EEG is helpful for establishing the diagnosis, classifying seizures correctly, and making therapeutic decisions.
- In combination with appropriate clinical findings, epileptiform EEG patterns termed **spikes** or **sharp** waves strongly support a diagnosis of epilepsy
  - Focal epileptiform discharges indicate focal epilepsy
  - Generalized epileptiform activity indicates a generalized epilepsy.
- Most EEGs are obtained between seizures, and interictal abnormalities alone can never prove or eliminate a diagnosis of epilepsy.
- Epilepsy can be definitely established only by recording a characteristic ictal discharge during a clinical attack.
  - ❖ 3Hz spike-and-wave activity occurs specifically in petit mal.

(If you find 3Hz wave -> it is typical absent; there's no 3Hz wave -> Atypical absent)
See the pictures in the next page.





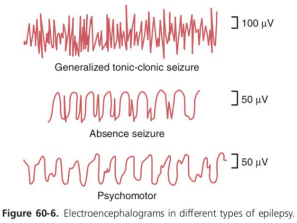
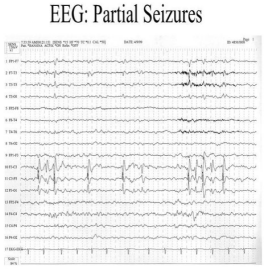
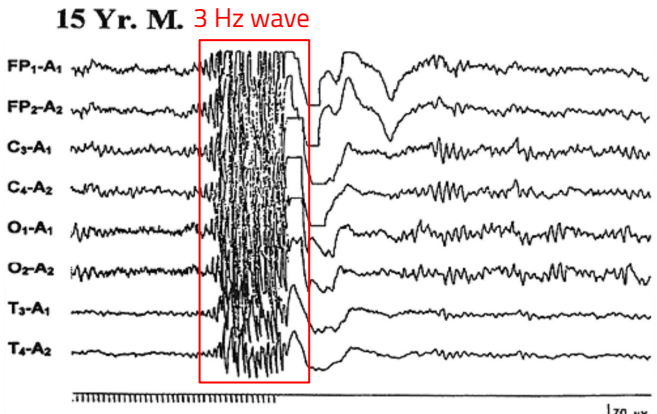


Figure 60-6. Electroencephalograms in different types of epilepsy.





★ The most important thing that you have to do EEG during the attack.

Pathophysiology of Epilepsy
(at molecular level)

Cortical cell membrane level

➢ Instability of the nerve cell membrane → Polarization abnormalities (excessive polarization, hypopolarization, or lapses in repolarization), allowing the cell to be more susceptible to activation → Hypersensitive neurons with lowered thresholds for firing and firing excessively, related to →

★ Very important

1) Excess of Excitatory (Acetylcholine -or Glutamate- related activity)
2) Decreased inhibitory (GABA –related activity)
    - Together and/or (2) above → leading to instability of cell membrane & lowered threshold for excitation → excessive polarization, hypopolarization allowing the cell to be more susceptible to activation spontaneously or by any ionic imbalances in the immediate chemical environment of neurons.

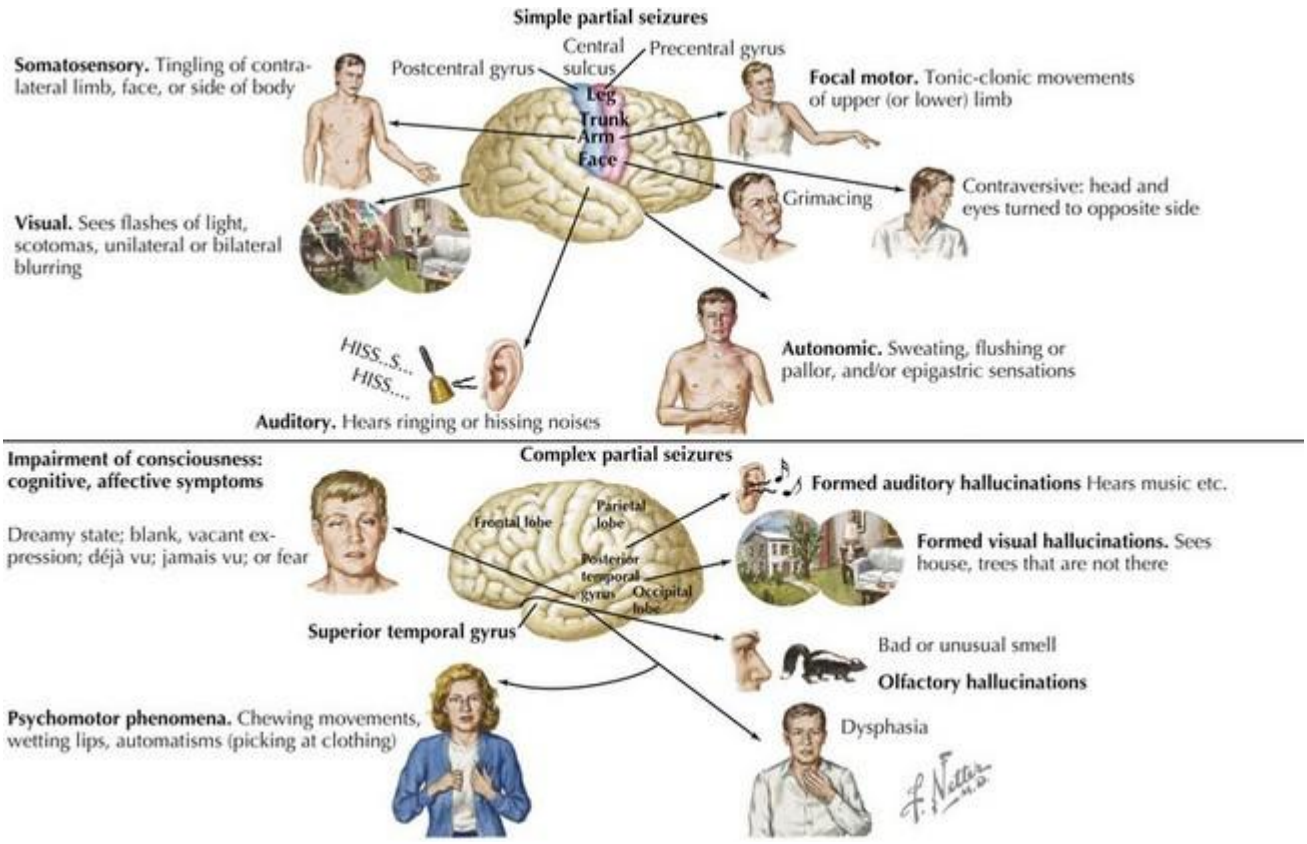
Genetic & Epilepsy

- Some types linked to genes (run in families).
- Genetic abnormalities ›››› increasing a person's susceptibility to seizures that are triggered by an environmental factor.
- Several types of epilepsy have now been linked to defective genes for ion channels, the "gates" that control the flow of ions in to and out of cells and that regulate neuron signaling.
- Example:
    - Lafora's disease, has been linked to a gene that helps to break down carbohydrates.
    - Benign neonatal convulsions -> 20q and 8q
    - Juvenile myoclonic epilepsy -> 6p
    - Progressive myoclonic epilepsy -> 21q22.3

Test yourself

1. What are the cause of seizures?
2. What is epilepsy?
3. Is it a disease or symptom?
4. What are the classification of epilepsy?
5. What are the phases of grand mal seizures?

- Remember not all the seizures are motor



MCQs

1.sclerosis of the hippocampus cause which one of the following condition?
- A. Temporal lobe seizures
- B. Jacksonian epilepsy
- **C.** Complex seizures
- D. Grand mal epileptic seizures

2.which one of the following grand-mal phases is characterized with jerk contraction and all muscle relaxation?
- A. Tonic phase
- B. Clonic phase
- C. Absence seizure
- D. Non convulsive

3.which one of the following is a clinical manifestation of seizures?
- A. Pins and needle sensation
- B. Hallucination
- C. Convulsion
- D. All above

4.which one of the following types of seizures is associated with spike and dome EEG pattern during seizures activity?
- A. Grand mal seizures
- B. Temporal seizures
- C. Jacksonian seizures
- D. Petit mal seizures

5.Epilepsy is characterized by.
- A. Increase excitatory activity of the neuron.
- B. Decrease excitatory activity of the neuron
- C. Increase inhibitory activity of the neuron
- D. Increase the threshold

SAQ

6.which epileptic condition involves a postictal depression period lasting from several minutes to perhaps as long as several hour?

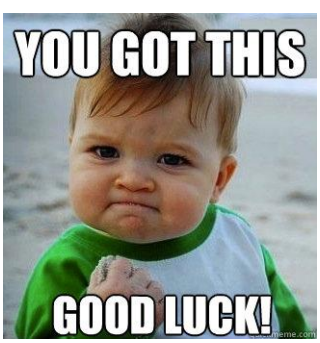
Gal mal seizures

7.Classifi seizures.
1. Partial seizures
2. Generalized seizures

8.Write 3 non-epileptic etiology of seizures
1. Meningitis
2. Hypoglycemia
3. Head trauma

9.Explain how epilepsy happens at molecular level.

Increase excitatory activity of the neuron and/or decrease inhibition which lead to lowering threshold and that lead to the cell more susceptible to activation by any ion imbalance.



1. A
2. B
3. D
4. D
5. A

دَقّاتُ قَلبَ المَرءَ قائلَةٌ لَهُ
إنَّ الحَياةَ دَقائقٌ وَثواني
فَارفَع لنَفسَكَ بَعدَ مَوتكَ ذكرَها
فَالذكرُ للإنسانَ عُمرٌ ثاني

أعضاء فريق علم وظائف الأعضاء لمقرر الجهاز العصبي
تحية طيبة لكم ،،،
من النبل أن نخبر عن إحسانكم وتفانيكم بإخراج هذا العمل بدءًا
من الإجازة الصيفية حتى نهاية هذا المقرر.
يسر الله خطاكم، ورفع قدركم وكتب أجركم في الدنيا والآخرة ❤
ولا ننسى من شكرنا القادة الأكاديميين لحرصهم على رفع جودة
العمل فجزاكم الله عنا خير الجزاء
كونوا بخير دائماً ،،،
القادة

عبدالإله الدوسري - علي العماري - رهف الشمري - فاطمة بالشرف

خلال فترة الإجازة الصيفية

- ★ رناد السويلمي، عبدالله الزيد، إسراء النزاوي، هيفاء العيسى
- ★ شهد الزهراني، ريم القرني، رهف الشنيبر، محمد الحسن، هشام الشايع
- ★ فهد الفايز، فيصل الطحان، خالد المطيري، أنس السيف، عبدالله السرجاني، عبدالعزيز الضرغام
- ★ عبدالعزيز الدخيل، فيصل السيف، عبدالجبار اليماني، زياد الخنيزان، صالح المعيقل، سيف المشاري، عبدالمجيد الوردي، محمد القحطاني، يزيد الخيال.

خلال فترة الدراسة

- ابتسام المطيري ، مها العَمري، ريناد المقرن، الفهدة السليم، غادة الحيدري، هديل المكينزي، رهام الحلبي، رناد السويلمي ، العنود العيسى، عهد القرين، أروى الجهني، عائشة الصباغ، العنود المنصور، معاذ عبدالغني ، عبدالله الزيد ، روان الحربي
- أفنان المصطفى، بلقيس الراجحي، دانة القاضي، مجد البراك، نورة القاضي، رهف الشنيبر، ريم القرني، ريناد الغريبي، سارة السلطان، شهد الطياش، شهد الزهراني، وجدان البدراني، هشام الشايع.
- فيصل الطحان، خالد المطيري، أنس السيف، سيف المشاري، تركي الشمري، عبدالعزيز الضرغام، ماجد الجهني، رشيد البلاع، محمد الحسن، عبدالمجيد الوردي، فايز الدرسوني.
- عبدالعزيز الدخيل، عبدالجبار اليماني، زياد الخنيزان، صالح المعيقل، سيف المشاري، محمد القحطاني، يزيد الخيال.

شكر خاص إلى: يزيد الحربي ❤

thank you