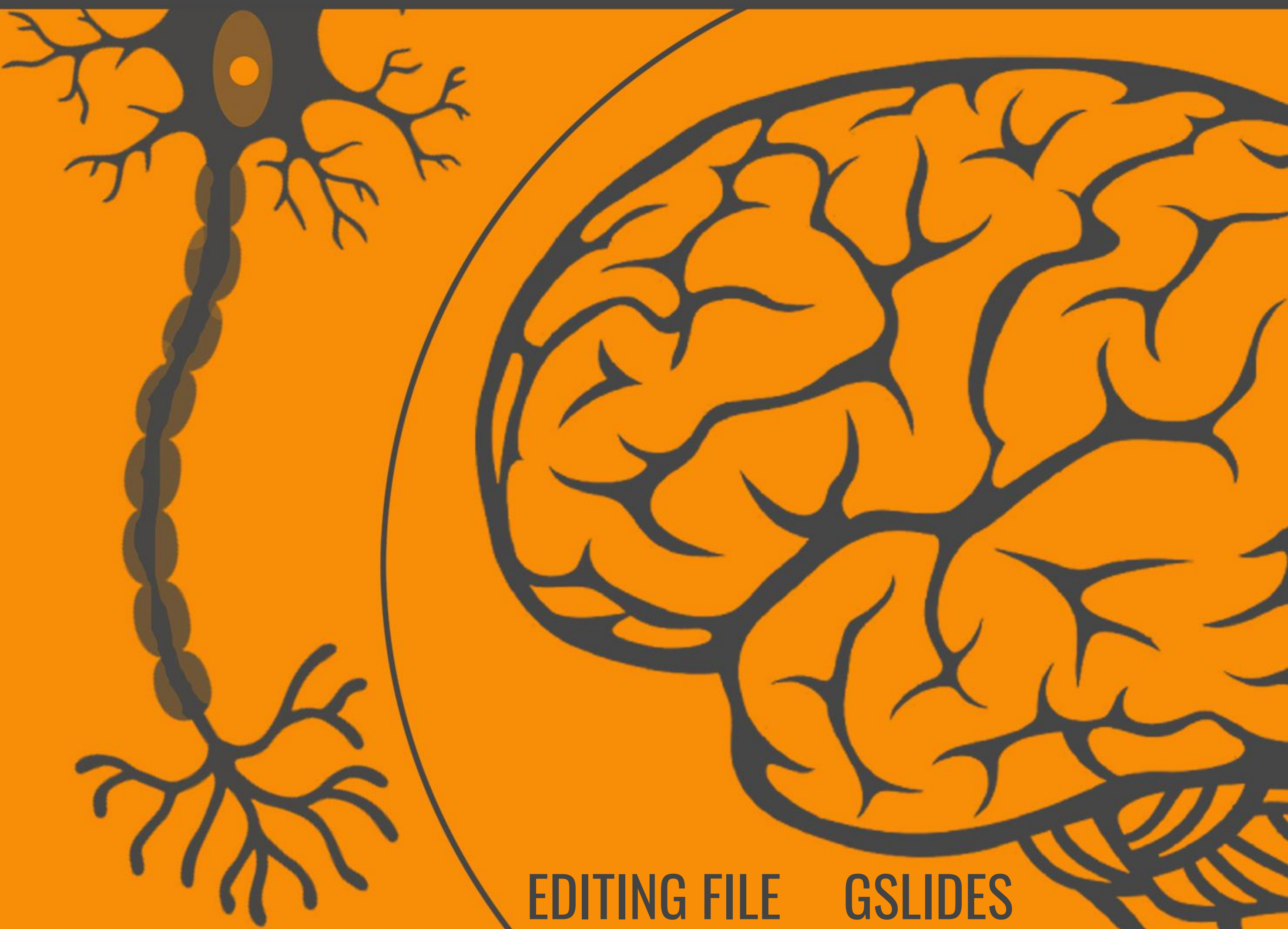


MEDICINE438's CNS PHYSIOLOGY

Lecture XXVII: Epilepsy



EDITING FILE

GSLIDES

IMPORTANT

MALE SLIDES

EXTRA

FEMALE SLIDES

LECTURER'S NOTES

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

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 surge¹ in electrical activity in the brain that causes an alteration in sensation, behavior, or consciousness.

Epilepsy

- Present when **2 or more unprovoked seizures² occur at an interval greater than 24 hour apart.**
- Sudden recurrent episodes of sensory disturbance.
- **With or without 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.
- **Hence seizures can be a symptom of epilepsy.**
- **very important to know epilepsy is not only motor disturbances, it could be sensory or psychomotor disturbances.**

Provoked seizures

Seizures induced by somatic disorders originating **outside the brain.**

- Examples are: fever, infection, syncope, head trauma, hypoxia, toxins, cardiac arrhythmias.
- **It is not considered as a symptom of epilepsy.**

FOOTNOTES

1. Surge: to suddenly move very quickly in a particular direction
2. Unprovoked seizures: it is seizures without underlying cause.

Classification Of Seizures

Partial or focal seizures	Generalized seizures
<ul style="list-style-type: none"> • their onset is limited to part of the cerebral hemisphere. <ol style="list-style-type: none"> 1. Simple partial seizures (Awareness not impaired). 2. Complex partial seizures (Awareness impaired). 3. Partial seizures secondarily generalizing. 	<ol style="list-style-type: none"> 1. Absence (most common): <ul style="list-style-type: none"> - Typical - Atypical 2. Tonic. 3. Clonic. 4. Tonic-Clonic. 5. Myoclonic. 6. Atonic.

Table 27-1

Simple Paetial Seizures

- Manifest as 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 (overfamiliarity)**, **Jamais vu (feeling of unreality)**
- The most common cause is **mesial temporal sclerosis**.

Jacksonian Epilepsy

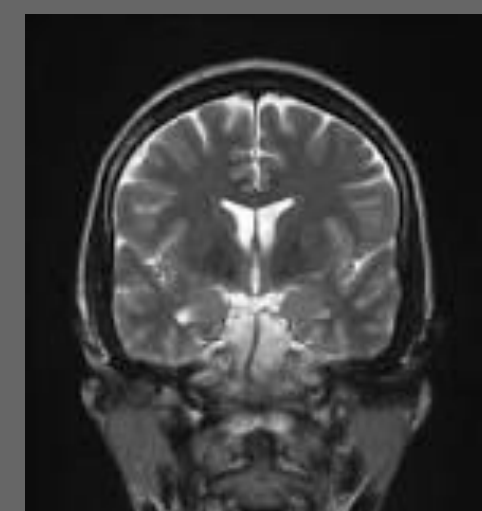
- Focal motor seizures begin in motor areas of cerebral cortex, usually begins with twitching of the thumb or finger, toe or the angle of the mouth.
- Spreading to involve the limbs on the side opposite the epileptic focus.
- Clinical evidence of this spread of activity is called the **march of the seizure**.

BOX 27-1: CLINICAL RELEVANCE

MESIAL TEMPORAL SCLEROSIS aka HIPPOCAMPAL SCLEROSIS

It is defined as severe gliosis with neuronal cell death of the hippocampus.

- Often misdiagnosed as alzheimer's.
- As we explained in our Brain and Aging lecture, there are two types of cortices, the six-layered neocortex or isocortex and a three-layered, less evolved allocortex. The latter is more prone to epilepsy, the hippocampus has a the three-layered allocortex.
- Remember, the hippocampus constitutes a part of the less-old olfactory system, therefore it is not surprising to expect olfactory changes in epilepsy affecting that region, since it is both involved in memory and olfaction.



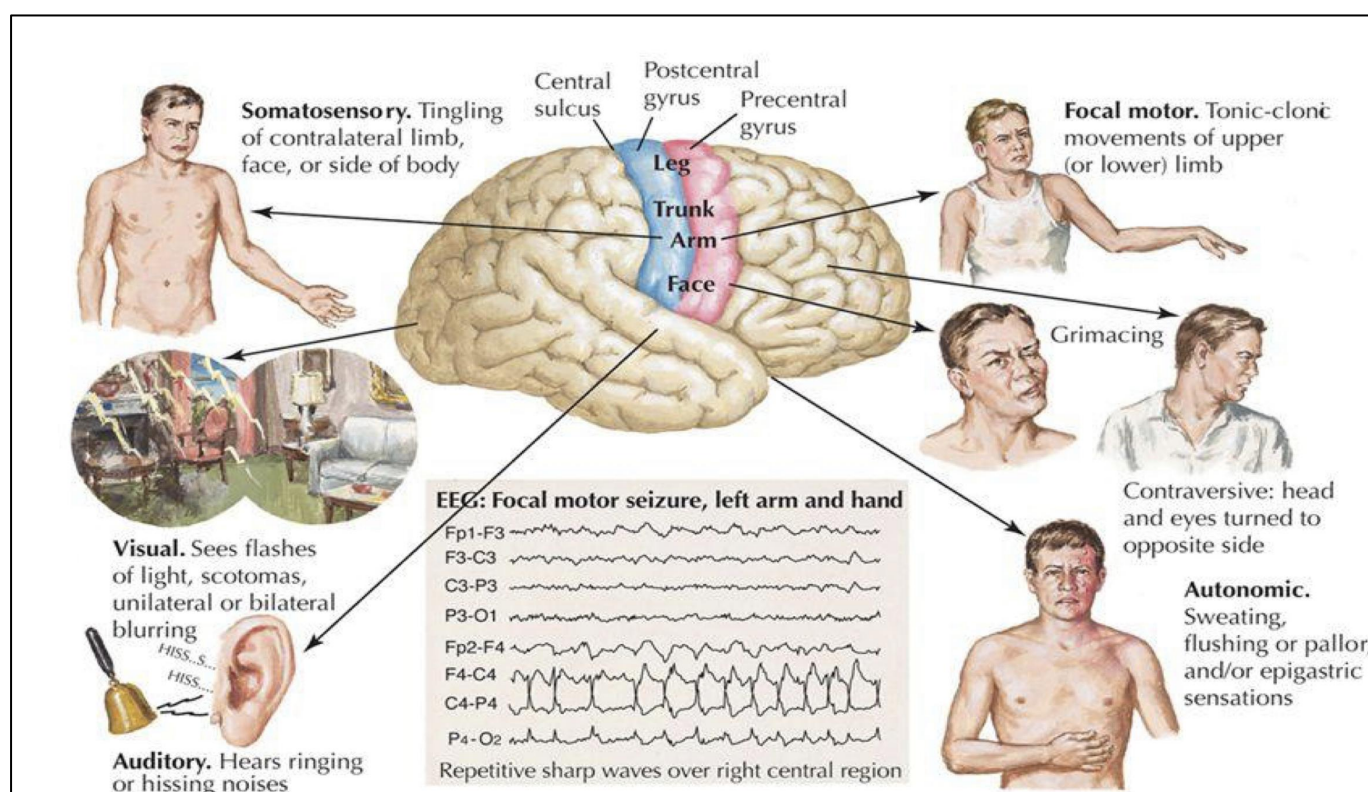


Figure 27-1

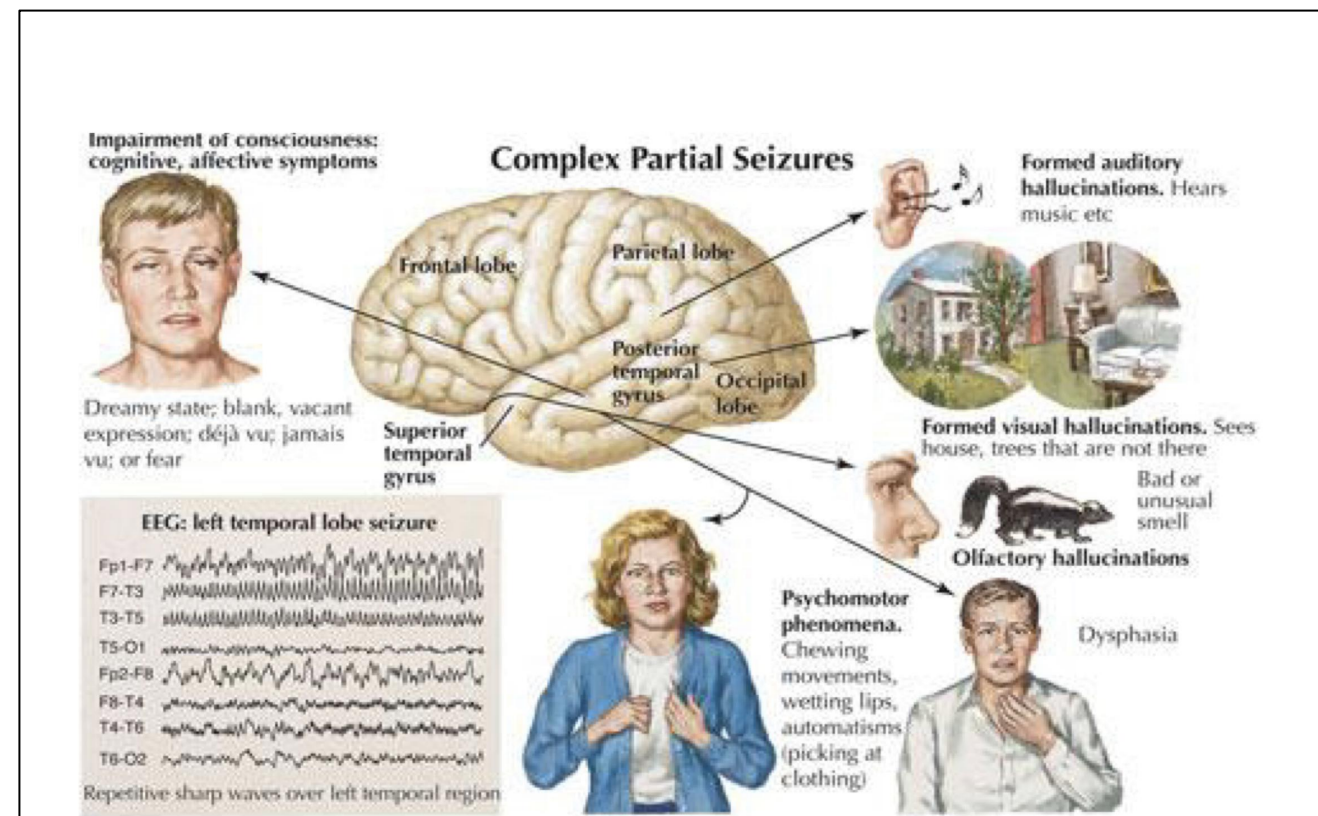


Figure 27-2

Complex Partial Seizures

- Manifest as **impairment of consciousness** with or without simple partial symptoms.

Generalized Seizures

- Involve the cerebral cortex diffusely (all of it) from the beginning.
- Manifest a loss of consciousness
- Convulsive or non-convulsive.
- The onset of a seizure: Small group of abnormal neurons undergo
 - Prolonged depolarization
 - 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 the thalamus got invaded).
- 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 in all the cortex and usually there's involvement of the thalamus.

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.

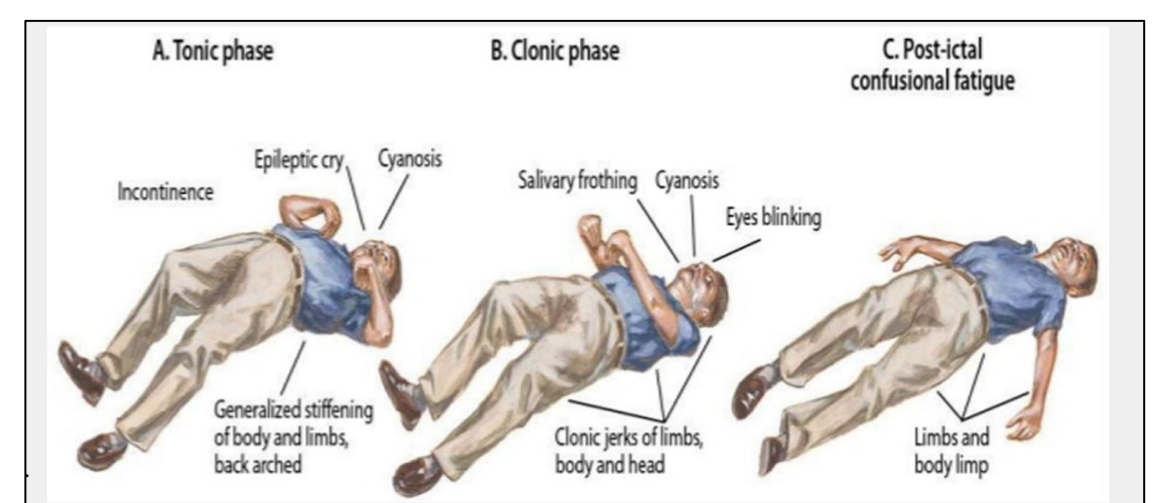


Figure 27-3

Tonic-clonic “Grand Mal epileptic seizure”

The phases of grand mal seizure it is important to know the phases in order and characteristics of each

- **+/- Aura** (abnormal sensation sensed by the patient himself) (peculiar sensation or dizziness aware sign; then sudden onset of seizure with loss of consciousness). **It's like a warning sign**
- **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”

- 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.** That's why it's difficult to diagnose.

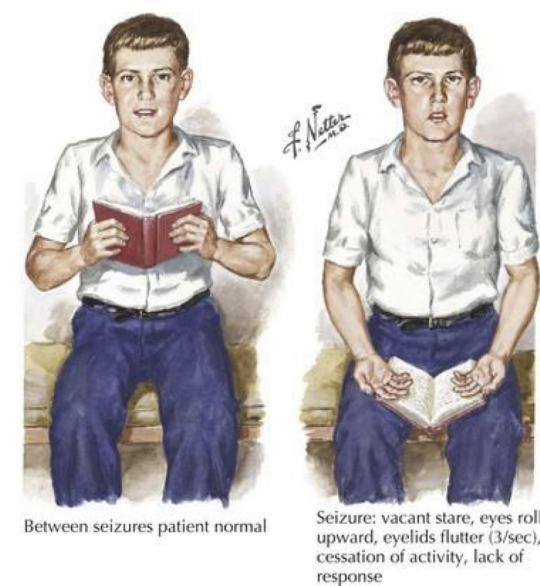


Figure 27-4

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:

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.
- A seizure that lasts for more than 10 minutes is called **status epilepticus**, it is a life-threatening medical emergency that may lead to permanent brain damage or death.

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 (Provoked Seizures)

- Febrile convulsions (Fever)
- Metabolic :
 - Hypoglycemia
 - HypoCa, HypoMg,
 - HyperNa, HypoNa.
- Head trauma
- Meningitis
- Encephalitis
- Poisons/toxins

Table 27-2

Genetics & 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. **Creating a hypersensitive ion channels in which they react to any stimulus leading to synchronized electrical activity.**
- Example:
 1. **Lafora's disease**, has been linked to a gene that helps to break down carbohydrates (glycogen)
 2. Benign neonatal convulsions -> 20q and 8q
 3. Juvenile myoclonic epilepsy -> 6p
 4. Progressive myoclonic epilepsy -> 21q22.3

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**.

Present Only in Male slides:

- Most EEGs are obtained between seizures, and **interictal (not during seizures) abnormalities alone can never prove or eliminate diagnosis of epilepsy.**
- Epilepsy can be definitely established only by recording a characteristic **ictal (during attack)** discharge during a clinical attack.
- ❖ **3Hz spike-and-wave (spike and dome pattern) activity occurs specifically in petit mal.**

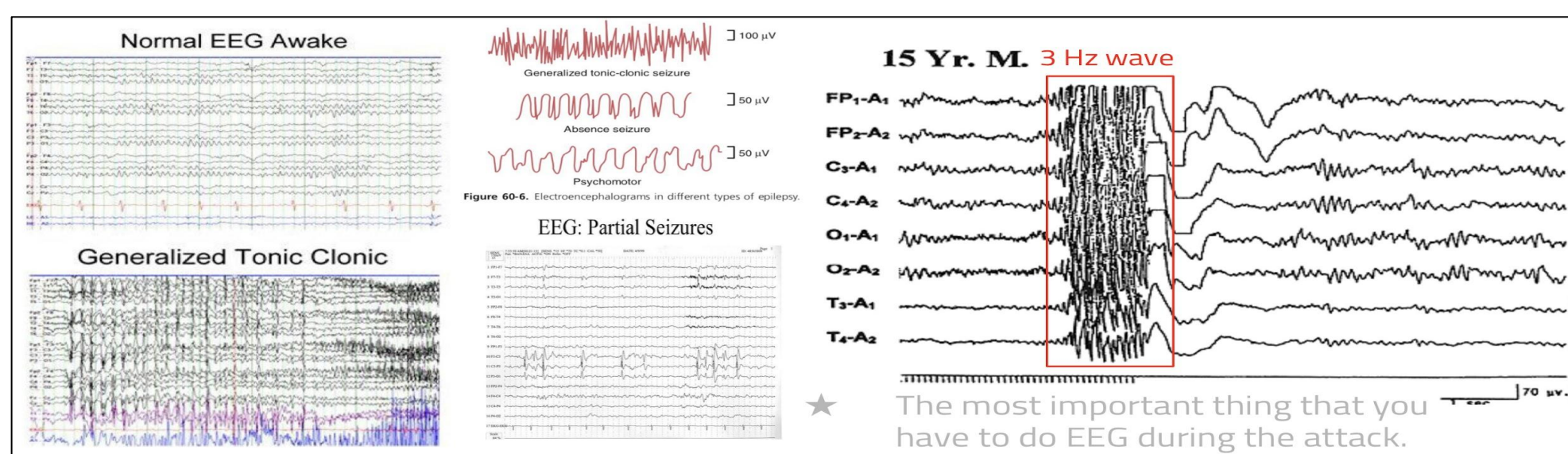


Figure 27-5

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 →
 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.

SUMMARY

- Epilepsy Present when 2 or more unprovoked seizures occur at an interval greater than 24 hour apart .
- Epilepsy can be due to motor , sensory , psychomotor disturbance .
- Examples of simple partial epilepsy : 1- partial psychomotor , 2- Jacksonian epilepsy .
- Examples of generalized epilepsy :
 - 1- Tonic-clonic “Grand Mal epileptic seizure”
 - 2- Absence “Petit Mal epileptic seizure” .
- Epilepsy is due to excess of excitatory neurotransmitters or decrease of inhibitory neurotransmitters .
- Interictal EEG alone can never prove or eliminate a diagnosis of epilepsy .
- The phases of grand mal seizure : 1: aura , 2: tonic phase , 3: clonic phase , 4: postictal state .

QUIZ



MEDICINE438's
CNS PHYSIOLOGY

1. Patient has focal seizure in occipital lobe, the patient will suffer from :
 - a) Staring with loss of awareness
 - b) Pins and needles sensations
 - c) Hallucinations
 - d) Smell and sounds that not there

2. Absence (petit mal) seizure is :
 - a) simple partial seizure
 - b) Complex partial seizure
 - c) Generalized seizure

3. Epilepsy can be diagnosed by EEG in Abnormalities :
 - a) Ictal
 - b) Interictal
 - c) Non above
 - d) EEG never alone prove epilepsy

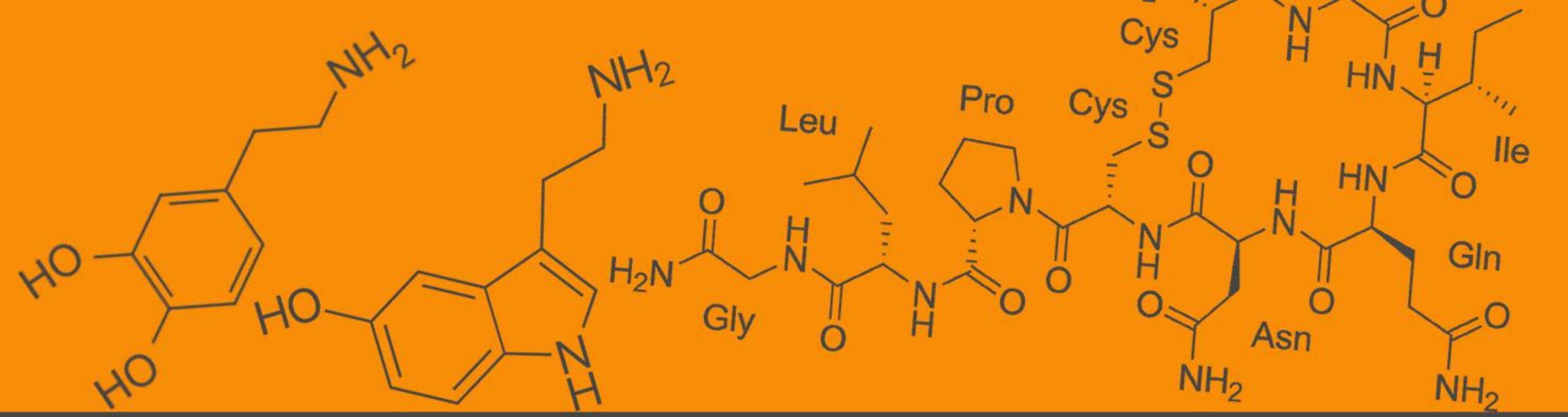
4. If patient has cerebral tumor and he developed seizures because of this tumor he will not be diagnosed with epilepsy :
 - a) True
 - b) False

SHORT ANSWER QUESTIONS

List the stages of tonic clonic (grand mal) seizures:

Answer : Page 4

ANSWER KEY: C, D, C, A, B



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