



Pathophysiology of Epilepsy



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- Important
- Further Explanation

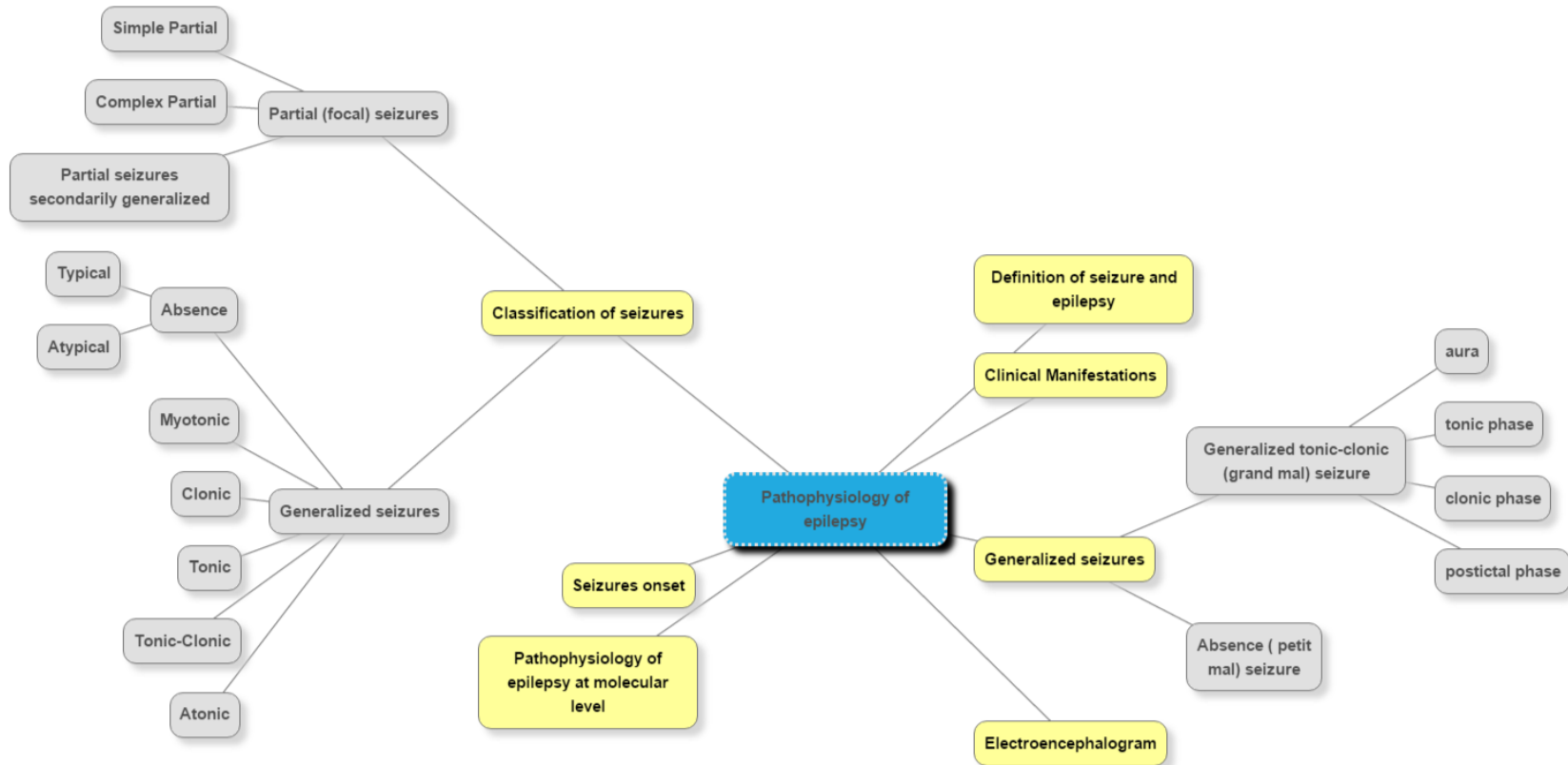
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Recommended Videos!



Please check out this link before viewing the file to know if there are any additions/changes or corrections. The same link will be used for all of our work [Physiology Edit](#)



Definition of Seizure¹ & Epilepsy²

Seizure's definitions

- ❖ 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
- ❖ Abnormal , excessive electrical discharge of a group of neurons within the brain.
- ❖ When there are **2 or more** significant, recurrent, unprovoked* seizures, we call that “epilepsy”
- ❖ Hence seizures can be a symptom of epilepsy .
- ❖ NB: not all people having seizures have epilepsy

Classification of seizures

Partial (focal) seizures

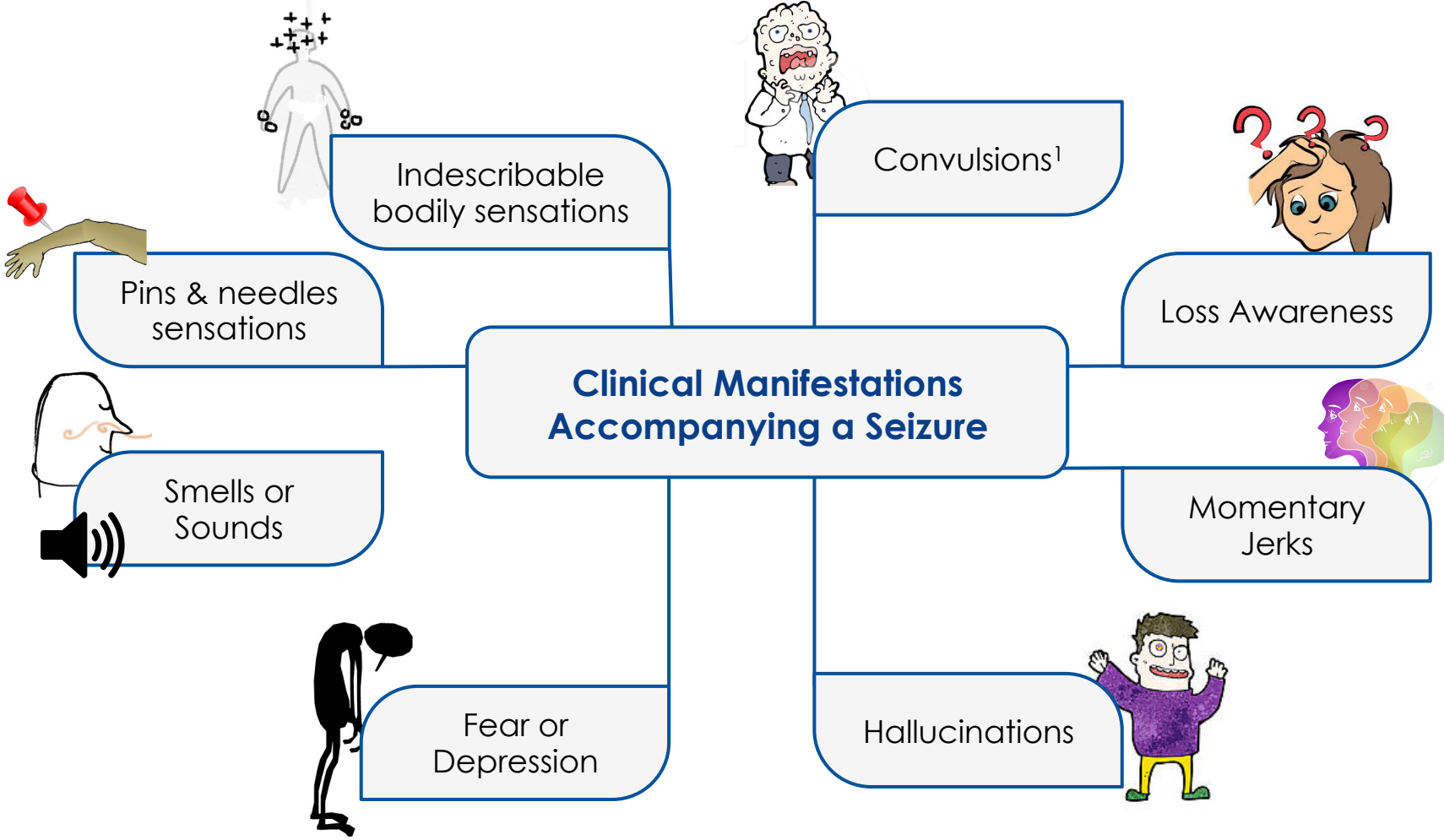
Involve a **limited** part of the cerebral hemisphere

- Simple partial — Awareness **NOT** impaired
- Complex partial — Awareness impaired
- Partial seizures secondarily generalizing

Generalized seizures

Involve the cerebral cortex **diffusely** (whole of it) from the beginning

- Absence
 - Typical
 - Atypical
- Myoclonic
- Clonic
- Tonic
- Tonic-clonic
- Atonic



1: Involuntary muscles contraction lasting seconds to minutes.

Causes & Types Manifestations

Simple Partial Seizures	Complex Partial Seizures	Generalized Seizures
<p>Manifest: LOCAL</p> <ul style="list-style-type: none">- Motor symptoms- Somatosensory symptoms- psychomotor symptoms <p>without impairment of consciousness</p>	<p>Manifest: Impairment of consciousness with or without simple partial symptoms</p> <p>Larger area is affected</p>	<p>Manifest: Loss of consciousness with numerous symptoms varies with the phases of the seizures.</p>

In people who have seizures, the brain's usual electrical activity is altered. Exactly what causes the changes to occur remains unknown in about half the cases. However, they are sometimes caused by underlying health problems, such as:

- Injury or Infections : head trauma , previous ischemia , encephalitis
- Metabolic disturbance : Very low blood levels of glucose, sodium, calcium or magnesium .
- Congenital or developmental abnormalities : **Genetics** , tumors

Genetics abnormalities increase the person susceptibility to seizures when they are triggered by environmental factors : they have been linked to defective genes **for ion channels (the gates)** That control the flow of ions into and out of the cells, which regulates neuronal signaling.

Generalized seizures

Generalized seizures are those that involve the cerebral cortex diffusely from the beginning , and are manifested by a **loss of consciousness** , and they could be convulsive or Non-convulsive.

❖ Petit Mal Epileptic Seizures :

They are called “**absence seizures**”.

Less sever seizure activity which patient loses consciousness and contact with environment for 5 to 30 seconds .

It appears like **day dreaming** or patient could exhibit **small twitching of muscles around the head and neck** such as rolling eyes , nodding head , moving hands and smacking lips.

Patient resume activity and is not aware of seizures.

It is thought to be due to abnormal thalamocortical function .

❖ Grand Mal Epileptic Seizures :

They are also called “**Tonic- clonic**” seizures , and they're the most sever seizures activity, and the result of intense discharges in many parts of the brain.

They involve multiple phases , but mainly initiated by **Tonic phase** followed by alternating **tonic- clonic phase** .

It is said that they occur in individuals predisposed to abnormal electrogenic circuitry in the brain.

Phases of Grand Mal seizures

Aura

It varies from person to another, but may include **peculiar¹ sensation, dizziness, strange smell or feeling of numbness**, followed by the sudden onset of the seizures with loss of consciousness.

Tonic Phase

Straightening of body and limbs due to **the rigid muscle contraction**, manifested by clenched jaw and hands, open eyes with dilated pupils. Lasts from 30 to 60 sec.

Clonic Phase

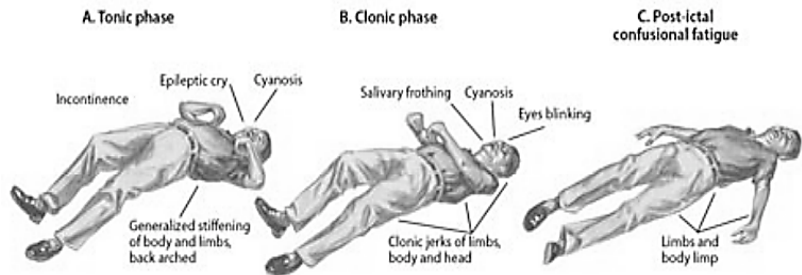
Rhythmic, **jerky contraction and relaxation of all muscles**.

Incontinence, frothing at the lips and some may bite tongue or cheeks during this phase. Lasts several mins.

Postictal State

A period of **disorientation** follows the grand mal seizures.

Is a neural depression leave the individual sleepy and fatigue for several hours.



Pathophysiology of Epilepsy

The onset of seizures :

- ❖ Small group of abnormal neurons undergo:
 - Prolonged depolarization
 - Rapid firing of repeated action potentials
- ❖ The action potential then spreads to adjacent neurons or neurons with which they are connected into the process.
- ❖ 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.



At the molecular level

Instability of cell membrane at the cortical level leads to susceptible cell membrane to polarization abnormalities (lower threshold) that **any ionic imbalance** in the immediate chemical environment of the neurons will spontaneously result in:

- 1- Excessive excitation (Ach, Glutamate)
- 2- Decreased Inhibition (GABA)

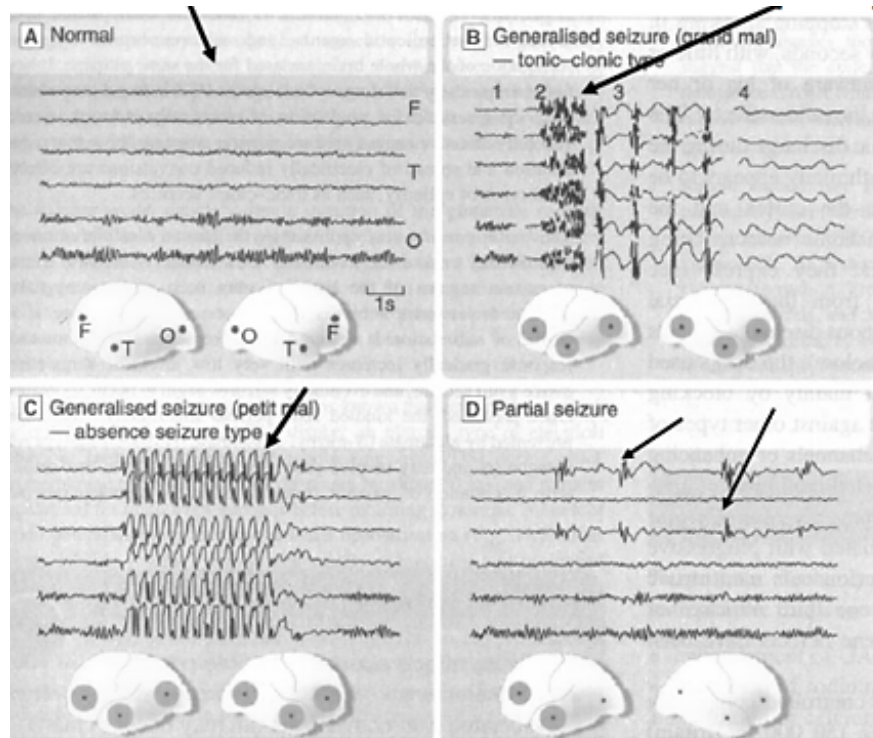
*for further understanding, you may check the 1st video linked in the second slide (it's less than a minute long)

Changes of Electroencephalogram

EEG is used to **diagnosis and classifying seizures** , and depending on it the therapeutic decisions are made !

Epileptiform patterns on EEG shows **Spikes or Sharp waves**

Grand mal seizures shows high voltage & high frequency patterns , while petit mal shows brief period of slow & spikes waves .



1- About half of the epileptic cases are caused by :

- A. Trauma
- B. Unknown
- C. Genetics
- D. Low blood sugar

2- Which of the following may indicate a seizure disorder ?

- A. Episodes of blank staring
- B. Convulsions with or without fever
- C. Involuntary jerky movement
- D. All of the above

3- During the tonic phase of generalized tonic-clonic type of epilepsy:

- A. The patient is aware of environment
- B. Back will arch and limbs will extend
- C. There is repeated contractions of muscles
- D. All of the above

4-The difference between generalized epilepsy and partial epilepsy on EEG

- A. No changes on EEG for both
- B. Focal changes are seen in both
- C. In Generalized changes are seen Bilateral
- D. Generalized Epilepsy shows local changes

5- Which of the following is not a part of the Ictal State ?

- A. Convulsions
- B. Loss of consciousness
- C. Incontinence
- D. Neuronal depression

6- Complex partial seizures are :

- A. Manifested by fully reserved consciousness
- B. Could be caused by hypersensitivity of the cell membrane
- C. Always caused by infections
- D. All of the above

1- How is the seizure diagnosed ? And how is it differentiated from other seizures?

. By EEG , Focal Epileptiform discharges indicate Partial Epilepsy and Generalized epileptiform discharges indicates Grand mal epilepsy .

2- What are the different phases of Grand mal epilepsy ?

. Tonic Phase (muscles rigidity) and Clonic phase (muscles contractions)

3- What is the pathophysiological mechanisms of seizures at the molecular level ?

. Input (one of the causes) ⇒ Instability of the cell membrane of neurons ⇒ polarization abnormality (Low threshold) ⇒ Excess excitation and less inhibition at any ionic disturbance .

4- What are the manifestations of Absence seizures ?

.It could be simply day dreaming appearance or accompanied by some motor activity due to muscle twitching like eyes rolling for example .

5- Describe the simple partial seizures .

. It is local seizures results from a seizure focal in the brain , and manifested by a local motor or sensory or psychotic symptoms

THANK YOU FOR CHECKING OUR WORK!

BEST OF LUCK

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STUDIED 29 PHYSIOLOGY LECTURES IN ONE BLOCK..

YOU ARE A LEGEND