1-introduction

Seizures: abnormal **hypersynchronous electrical discharge** of neurons in the brain, producing **clinical dysfunction**

-**MCC** and most **dramatic** neurological problem, **10%** one time.

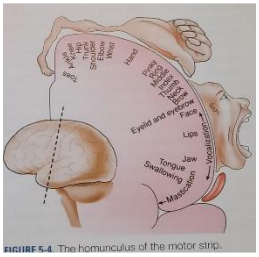
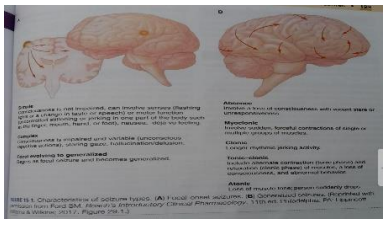
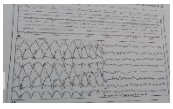
Epilepsy: the **tendency** to have recurrent **unprovoked** seizures

-**diagnosed** after having **two** unprovoked seizures

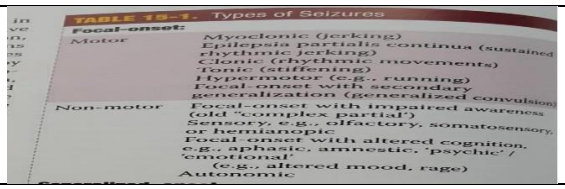
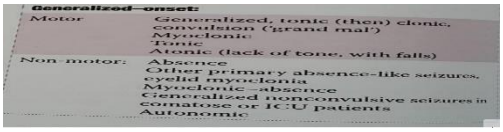
2-classification:

-diagnosed and categorized due to semiology (signs, symptoms)

-**secondary generalized:** seizures that arise from one portion then spread to involve the whole brain

	Focal seizures	Generalized seizures
Definition:	-arise from one **specific focus** within the brain and do not impair awareness at least at the onset - lead to **positive** rather than negative neurologic symptoms (tingling not numbness, visual hallucinations not blindness) -manifestation depends on the site of origin in the brain (motor or non-motor)	involves **both cerebral** hemispheres at the onset
Classification:	1-awareness is impaired **vs** preserved 2-motor **vs** non-motor	1-motor seizures **vs** absence seizures
types  FIGURE 5-4 The homunculus of the motor strip.	**1-motor:** -involve the motor cortex in the **frontal lobe** (one part of the body may stiffen or jerk rhythmically) -**Jacksonian march: electrical activity spreads** along the **motor strip** leading to rhythmical jerking that spreads along body parts following the organization of the **motor homunculus.**(distal to proximal)	**1-motor seizures:** -previously referred to as **generalized tonic-clonic (GTC) seizures** or **grand mal seizures** -most familiar -the patient may **bite the tongue** and become **incontinent of urine** **Phases:** **1-tonic phase:** the **entire body** becomes **stiff** (including the **chest** and **pharyngeal muscles** which may lead to vocalization known as **epileptic cry**) .it lasts **several seconds.** **2-clonic phase:** **limbs jerk rhythmically**, more or less symmetrically, for **less than 1-2 min** -**toward the end** of the phase **the jerking may decrease** and stop as the body becomes **flaccid** **postictal state:** **-** the patient is **tired or confused**, before returning to normal activity slowly, it lasts **minutes to hours**
	**2-non motor:** **-involve** **Parietal lobe >** sensory phenomena **Occipital lobe>** visual phenomena **Temporal love >**gustatory, olfactory, and psychic -the latter **may include** (déjà vu, jamais vu, sensation of depolarization<out of body>,derealization)	**2-absence seizures: (petite mal absence)**  -most commonly in children and adolescents -characterized by: **(an unresponsive period** often with **staring,** lasts for **several seconds** with **immediate recovery)** -con occur **tens** or **even hundreds** of times a day -usually noticed by **schoolteachers** and assumed to be **daydreaming** or **difficulty concentrating** **-hyperventilation** is a common trigger -**A classic 3-per-second generalized spike-and-wave** electroencephalogram **(EEG)** pattern

	3-simple -Preserve consciousness **-can involve** 1-senses: Flashing lights, change in taste, speech 2-motor: Uncontrolled stiffening or jerking in one part of the body such as (fingers, mouth, hand, or foot) 3-nausea 4-dega vu feeling	**4-juvenile myoclonic epilepsy (Janz syndrome)** - **common** form of **primary** generalized epilepsy -occurred in teens -clinical triad: 1-infrequent generalized seizures often **on walking** 2-**daytime absences** 3-sudden, shock-like, involuntary **jerking movements (myoclonus)** usually in the **morning.** **Kellog`s epilepsy:** patient inexplicably spills their breakfast or throws it across the room -the **EEG** shows **polyspike-wave** discharges and **photosensitivity** **-treatment:** 1-**Sodium valproate** (recurrence is likely if medication is stopped) 2-If Failed use alternative drugs: **Clonazepam, levetiracetam** and **lamotrigine** -it is important to **differentiate** this benign condition from other childhood conditions where severe myoclonus and epilepsy are associated with underlying **degenerative disease of the brain** (progressive myoclonic epilepsies) **Why?** If treated incorrectly with **carbamazepine** than **valproate** may worsen
	4-complex partial seizures -**consciousness is impaired** 1-variable (unconscious repetitive actions) 2-Staring gaze 3-Hallucination/ delusion -arise in the temporal and frontal lobe -may include **automatisms** (motor actions without clear purpose) like **(lip smacking, chewing movements, or picking at clothing)** **-** the patient may have **speak arrest** or speak in a **nonsensical manner** -The patient **does not respond normally** to the environment or to questions or commands -**occasionally:** may continue the activities they were participating in at the onset of the seizures, sometimes to remarkable lengths. (continue folding laundry, finish driving home during seizure) **-complex focal seizures of frontal lobe** origin may involve strange **bilateral movements**, such as **bicycling or kicking**, or behavior such as **running in circles**	**Other generalized seizure types** -**less common seizure types:** 1-myoclonic-atonic 2-clonic-tonic-clonic 3-myoclonic absence 4-absence with eyelid myoclonia Myoclonic seizures (without other features May be **generalized or focal**)
	5-focal involving to generalized: Began as focal and became generalized -from focal to bilateral tonic-clonic (to bilateral symptoms) -focal bilateral tonic-clonic was previously termed partial onset with secondary generalization	

3-Epidemiology and etiology:

-**age of onset:** very young and very old

-**etiology** depends on the age of onset

infant	1-neonatal infection 2-hypoxic-ischemia insults 3-genetic syndromes 4-congenital brain malformation
children	**Febrile seizures** -**most common** cause of seizures in **children** -occur at ages between **6 months and 5 years** -in the setting of a febrile illness **without evidence of intracranial infection** -usually **generalized** in onset -most affected children **do not have a neurologic deficit** -to consider as a febrile seizure:(the **fever** must be present **before the seizure** or must develop in the **immediate postictal period**) -the **risk of subsequent epilepsy** is relatively **small** **unless:** 1- the seizures are **prolonged** or **focal** in onset 2-other **neurological abnormalities** or a **family history of epilepsy** is present
Older children	1-head injury 2-meningitis, encephalitis 3-vascular disease 4-genetic syndromes
Young adult	1-head injury 2-substance use 3-excessive alcohol
Middle age	1-brain tumors 2-strokes
elderly	1-strokes (MC) 2-substance use and alcohol (not uncommon) 3-metabolic disturbances from systemic problems (hypo or hyperglycemia, hepatic failure, or renal failure)

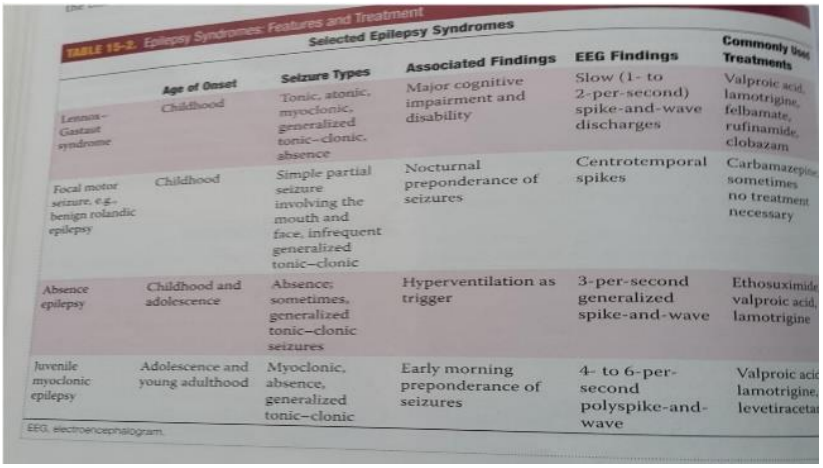


TABLE 19–2. Epilepsy Syndromes: Features and Treatment

Selected Epilepsy Syndromes					
	Age of Onset	Seizure Types	Associated Findings	EEG Findings	Commonly Used Treatments
Lennox–Gastaut syndrome	Childhood	Tonic, atonic, myoclonic, generalized tonic–clonic, absence	Major cognitive impairment and disability	Slow (1- to 2-per-second) spike-and-wave discharges	Valproic acid, lamotrigine, felbamate, rufinamide, clobazam
Focal motor seizure, e.g., benign rolandic epilepsy	Childhood	Simple partial seizure involving the mouth and face, infrequent generalized tonic–clonic	Nocturnal preponderance of seizures	Centrotemporal spikes	Carbamazepine, sometimes no treatment necessary
Absence epilepsy	Childhood and adolescence	Absence; sometimes, generalized tonic–clonic seizures	Hyperventilation as trigger	3-per-second generalized spike-and-wave	Ethosuximide, valproic acid, lamotrigine
Juvenile myoclonic epilepsy	Adolescence and young adulthood	Myoclonic, absence, generalized tonic–clonic	Early morning preponderance of seizures	4- to 6-per-second polyspike-and-wave	Valproic acid, lamotrigine, levetiracetam

EEG, electroencephalogram.

4-clinical manifestation:

4. CLINICAL MANIFESTATIONS

A) History

The diagnosis of seizures is a clinical one

Most commonly the patient is seen after an event has occurred, and the diagnosis must be made on the history alone

In these cases, the patient (and more importantly, witnesses, if the seizure was generalized in onset) must be questioned for an exact description of the event itself(and especially the onset), any premonitory symptoms, and the character of the recovery period in order for the clinician to decide whether the event was a seizure

and, if so, what type of seizure it was

The clinical details should allow differentiation of seizures from other paroxysmal neurologic events (table)

B) Physical examination

The neurologic examination is most helpful diagnostically in the (relatively uncommon) instances in which the patient is observed during the event or shortly thereafter

In the latter case, a postictal hemiparesis, or Todd's paralysis, may be detected after a bilateral tonic, then clonic seizure; this suggests that the seizure was of focal onset, even if not apparent to observers at that time

Other abnormalities on neurologic examination may also suggest the presence of a focal brain lesion

Of course, the general physical exam may yield findings suggestive of infection or other systemic disease that might explain a new-onset seizure

In particular, signs of meningitis should be sought in any patient who has had a seizure

TABLE 15-3. Characteristics of Focal Seizures and Other Paroxysmal Neurologic Events

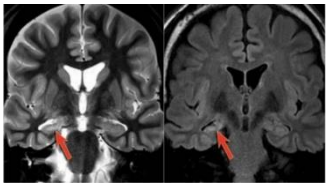
	Focal Seizures	Transient Ischemic Attacks	Migraine
Onset	Progression of symptoms over seconds	Sudden onset of symptoms	Progression of symptoms over 15–20 min
Neurologic symptoms	Positive motor or sensory symptoms; "psychic" symptoms such as déjà vu	Negative motor, sensory, or visual symptoms (loss of function)	Positive sensory and, especially, visual symptoms such as scintillating scotomata
Duration	Usually less than a few minutes	Usually less than 30 min, always less than 24 h	Symptoms for 15–20 min, typically followed by headache for hours
Consciousness	Preserved or impaired	Preserved	Preserved
Headache	Occasionally postictal	Infrequent	Throbbing pain, often unilateral, following the progression of initial symptoms
			Fatigue common
Recovery	Postictal confusion, sleepiness	Rapid	
Risk factors	Structural brain lesion, family history of seizures	Hypertension, hyperlipidemia, smoking, diabetes, atrial fibrillation, stenotic intracranial or extracranial vessels, hypercoagulability	Family history of migraines

Disturbances of consciousness

Fig 5.1 Differentiating syncope from seizures

	Syncope	Seizures
Relationship to posture	Usually when standing	Unrelated
Prodrome	Hypotensive symptoms: e.g. light-headed/faint, blurred/dim vision, sounds seem distant, tinnitus, perception of weakness, nausea, hot/cold, sweating	None or symptoms of a simple partial seizure/aura, e.g. déjà vu, epigastric rising sensation, feeling of anxiety and fear, focal sensory symptoms, focal twitching
Skin colour	Pale	Blue or normal
Respiration	Shallow	Stertorous (noisy)
Tone	Floppy (may jerk)	Tonic–clonic in a generalized seizure
Convulsion	Rare	Common
Urinary incontinence	Rare (though can occur)	Common
Tongue biting	Rare	Common
Recovery phase	Rapid Usually no confusion Pallor may persist	Often prolonged Confusion common and prominent
Focal neurological symptoms	No	Occasional
Clues to underlying aetiology	Situational, e.g. having blood taken Cardiac arrhythmia Aortic stenosis Cardiomyopathy Postural hypotension	History of known epileptic seizures Structural lesion in brain, e.g. tumour Severe head injury

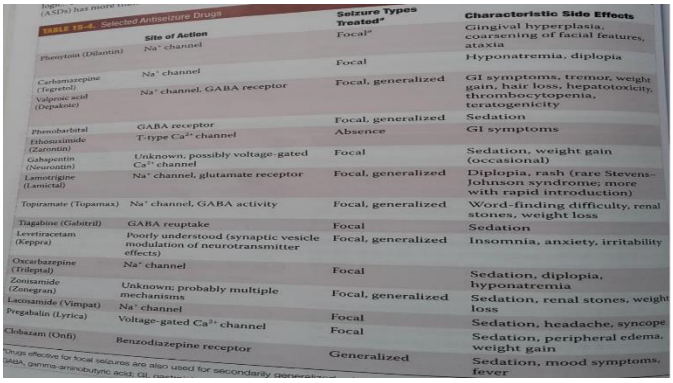
5-diagnostic evaluation:

Laboratory studies	1-**metabolic abnormalities** (hyponatremia, hypocalcemia) 2-**serum bicarbonate** (generalized seizure >lactic acidosis> decrease serum bicarbonate) 3-**toxicology screen** (substance abuse) +**alcoholic level** 4-**pregnancy test** 5-**lumber puncture** (suspected infection)
Brain imaging 	1-used in **new-onset** seizures 2-for seizures of probable **focal onset** (no need in known epilepsy patients with uncomplicated seizures) **MRI:** structural abnormalities that is the focus for that seizure **CT:** used in urgent sitting
Electroencephalography (EEG)	**Useful for several reasons:** 1-identify a **potential focus** of seizure **onset** 2-show **abnormalities characteristic** of a specific epilepsy syndrome 3-establish whether a patient who has had a seizure and is **not regaining alertness** promptly is **postictal** or is having **ongoing continuous nonconvulsive seizures** -in patients with known epilepsy up to 50% of routine EEGs are normal -diagnosis of the paroxysmal event if it was a seizure or not depends primarily on clinical ground

6-Treatment:

<table>
<tr><td>1-drugs</td><td>-mainstay treatment, goal (eliminate seizures and avoid SE)
-not initiated after single seizure, especially in symptomatic seizures (seizures due to treatable or reversible conditions like meningitis, alcohol withdrawal, or hyponatremia unless there are risk factors that indicate a high likelihood of seizure recurrence
-initiated after two unprovoked seizures

How to use it?
-increase the dose of the 1st drug until the seizure is controlled or SE appears
when SE occurs> the dose is lowered and 2nd drug may be added
after controlling the seizure> taper the 1st drug, leave the second

-70% is controlled with 1st drug only, the rest with 2 or more or the seizures remain refractory to medical treatment
 
<table>
<tr><th>Site of Action</th><th>Seizure Types Treated*</th><th>Characteristic Side Effects</th></tr>
<tr><td>Phenytoin (Dilantin)</td><td>Na+ channel</td><td>Focal*</td><td>Gingival hyperplasia, coarsening of facial features, ataxia</td></tr>
<tr><td>Carbamazepine (Tegretol)</td><td>Na+ channel</td><td>Focal</td><td>Hyponatremia, diplopia</td></tr>
<tr><td>Valproic acid (Depakote)</td><td>Na+ channel, GABA receptor</td><td>Focal, generalized</td><td>GI symptoms, tremor, weight gain, hair loss, hepatotoxicity, thrombocytopenia, teratogenicity</td></tr>
<tr><td>Phenobarbital</td><td>GABA receptor</td><td>Focal, generalized</td><td>Sedation</td></tr>
<tr><td>Ethosuximide (Zarontin)</td><td>T-type Ca2+ channel</td><td>Absence</td><td>GI symptoms</td></tr>
<tr><td>Gabapentin (Neurontin)</td><td>Unknown, possibly voltage-gated Ca2+ channel</td><td>Focal</td><td>Sedation, weight gain (occasional)</td></tr>
<tr><td>Lamotrigine (Lamictal)</td><td>Na+ channel, glutamate receptor</td><td>Focal, generalized</td><td>Diplopia, rash (rare Stevens-Johnson syndrome; more with rapid introduction)</td></tr>
<tr><td>Topiramate (Topamax)</td><td>Na+ channel, GABA activity</td><td>Focal, generalized</td><td>Word-finding difficulty, renal stones, weight loss</td></tr>
<tr><td>Tiagabine (Gabitril)</td><td>GABA reuptake</td><td>Focal</td><td>Sedation</td></tr>
<tr><td>Levetiracetam (Keppra)</td><td>Poorly understood (synaptic vesicle modulation of neurotransmitter effects)</td><td>Focal, generalized</td><td>Insomnia, anxiety, irritability</td></tr>
<tr><td>Oxcarbazepine (Trileptal)</td><td>Na+ channel</td><td>Focal</td><td>Sedation, diplopia, hyponatremia</td></tr>
<tr><td>Zonisamide (Zonegran)</td><td>Unknown; probably multiple mechanisms</td><td>Focal, generalized</td><td>Sedation, renal stones, weight loss</td></tr>
<tr><td>Lacosamide (Vimpat)</td><td>Na+ channel</td><td>Focal</td><td>Sedation, headache, syncope</td></tr>
<tr><td>Pregabalin (Lyrica)</td><td>Voltage-gated Ca2+ channel</td><td>Focal</td><td>Sedation, peripheral edema, weight gain</td></tr>
<tr><td>Clobazam (Onfi)</td><td>Benzodiazepine receptor</td><td>Generalized</td><td>Sedation, mood symptoms, fever</td></tr>
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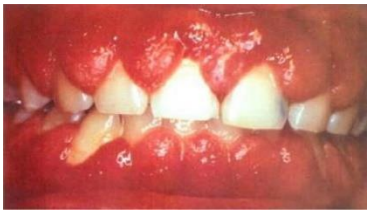
 </td></tr>
<tr><td>2-ketogenic diet</td><td>-high fat and protein, low carbohydrate diet
-monitor the therapy >produced urine and plasma ketones
-effective in adult and pediatric seizures (good evidence of efficacy in pediatric syndromes)
-disadvantages
1-difficult to tolerate by patient
2-not safe with other medical comorbidities (lipid disorder)</td></tr>
<tr><td>3-vagus nerve stimulator</td><td>-efficient in Tx of generalized and focal seizures
-Implanted subcutaneously below the clavicle to stimulate the left vagus nerve
How?
Through programmed electrical impulses delivered through leads placed in the neck

Under development treatment:
Devices to direct brain stimulation (transcutaneous magnetic stimulation, deep brain stimulation)</td></tr>
<tr><td>4-surgery</td><td>-used when the patient is refractory to medical TX
-MC surgery is the resection of epileptogenic area (presurgical identification of the seizure focus by continuous video-EEG monitoring +neuroimaging + other tests)
-MC target of epilepsy surgery is the medial temporal lobe (over 60% seizure freedom)
-lees commonly used surgical producers include the corpus callosotomy, hemispherectomy, multiple transaction</td></tr>
</table>

1-status epilepticus:

-an abnormal state in which either 1-seizure is continuous for a **prolonged period** or 2-seizure are **so frequent** that there is **no recovery of consciousness** between them.

Several types:

1-**generalized convulsive** form (ongoing **clonic** movements of the limb)

2- the patient may be **unresponsive**

3-subtle **motor sign** such as **eyelid twitching** or **nystagmus**

Causes:

1-metabolic disturbances

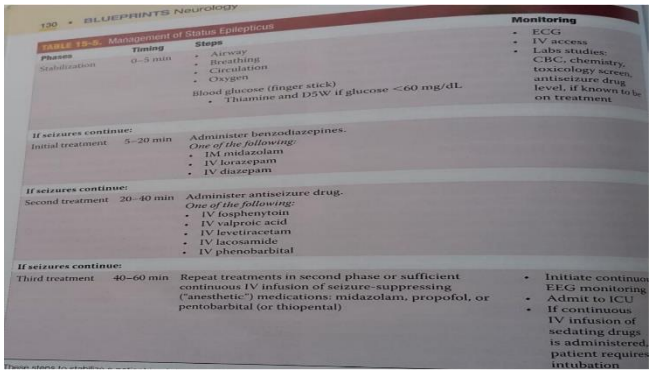
2-underling epilepsy

3-hypoxic-ischemic damage of the brain

4-toxic or infection insult

-Considered a **medical emergency**, with **high morbidity** and the **management** focuses on:

(Stopping the seizure activity, preventing the occurrence of systemic complication)



It's important to:

1-consider the ongoing nonconvulsant seizures if convulsions have ceased but mental status remains impaired.

2-frequent seizure clusters may require aggressive management, as they can quickly progress to status epilepticus

8-special topics:

A-first aid for seizure

-to prevent the injuries of the patient, and unwisely bystanders' intervention

-in complex partial seizures patients make semi-purposeful movements > should be guided gently away from harm

-more aggressive attempts at restraint may provoke a violent reaction

-GTCs patient

1-should be laid on his side > to prevent aspiration with vomiting

2-loosen the tight clothes

3-noting should be placed in mouth

4-no need for medical attention unless there is a prolonged seizure (normal 1-2 min)

B-sudden unexpected death in epilepsy (SUDEP)

- sudden unexpected death in an epilepsy patient who is otherwise healthy

-rare in children (1 in 4500), and more common in adults (1 in 1000)

-Risk factors:

1-high frequency of GTCs (Tx and decreased frequency can decrease the risk)

2-longer duration of epilepsy diagnosis

3-age:18 to 40 years

4-alcohol use

5-missing ASD dose

-counsel the patient and families about SUDEP and the importance of TX in decreasing the occurrence

c-psychogenic nonepileptic seizures

-10 to 30% of medically refractory epilepsy

-lake EEG correlation and are psychogenic in nature, have comorbid psychiatric illnesses or a history of abuse

-some can have true epileptic seizures at other times

-to depreciated form epileptic seizures >continuous video-EEG monitoring

d-seizure and driving:

-need specific seizure-free interval exceptions: 1-purely nocturnal seizures 2-prolonged focal onset with preserved awareness

- all patients should be counseled about driving restrictions

f-Antiseizure drug and pregnancy:

-ASDs are teratogens (valproic acid >higher rate of neural tube defects)

-women with epilepsy planning pregnancy should take at least 1mg of folic acid daily

Done by Maysana AL-yacoub