CCHCS Care Guide: Seizure Disorders

SUMMARY | **DECISION SUPPORT** | **PATIENT EDUCATION/SELF MANAGEMENT**

GOALS

- ✓ Identify and classify type of seizure
- ✓ Avoid drug-drug interactions
- ✓ Minimize seizures through appropriate therapy
- ✓ Minimize adverse events, including potentially avoidable hospitalizations

ALERTS

- Signs and symptoms of drug toxicity
- Ensure antiepileptic drug (AED) adherence
- Seizures lasting > 5 minutes
- History of traumatic brain injury (TBI)
- Contraception, pregnancy, and menopause

TREATMENT OPTIONS

Initiating Medication	• Medication is not indicated after a first seizure in most patients. Evaluate need for therapy on an individual basis. • Offer AEDs after first tonic-clonic seizure if: ✓ Prior history of absence, myoclonic or focal seizures ✓ Congenital neurologic defect ✓ Electroencephalography (EEG) with epileptic discharge ✓ Recurrence risk unacceptable to patient • Medication selection is dependent in part on seizure class and epilepsy syndrome. • Optimize monotherapy before considering second agent. • Encourage adherence, monitor side-effects, ensure good control is maintained and educate patient. • AEDs usually not indicated for provoked seizures. Treat underlying cause if possible. Discontinue prophylactic AEDs unless seizures reoccur.
Drug-Resistant Seizures	• If seizures are uncontrolled, or patient is not seizure free at maximally tolerated doses of initial AED, consider changing to a different first line AED. Titrate new medication to therapeutic level prior to tapering initial AED. • Consider psychogenic nonepileptic seizure diagnosis. Pseudoseizures may have physiologic or psychogenic etiology (see page 2). • Consult neurology if seizures are not well controlled on two medications.
CDCR Housing/Activity Restrictions	• Complete a CDCR 7410, Comprehensive Accommodation Chrono for bottom bunk. • Consider lower tier also in selected cases. • Issue restrictions on driving, operating heavy equipment, working with heat, and working at heights.
Status Epilepticus	• The principal goal of treatment is to emergently stop seizure activity. The initial treatment strategy includes simultaneous assessment and management of airway, breathing, and circulation (obtain IV access, administer O_2, and secure the airway as needed), check vital signs, fingerstick glucose, seizure abortive drug treatment (i.e., lorazepam) and emergent transport to a higher level of care (see pages 3 & 6).

MONITORING

- Measure baseline CBC, BUN/creatinine, LFTs, electrolytes, and albumin prior to starting AED therapy.
- Monitor CBC, BUN/creatinine, LFTs, electrolytes as indicated.
- Monitor for adverse effects.
- Obtain AED level to establish baseline when stable dose is achieved for agents where drug levels are useful to monitor adherence or when seizure control changes. (AEDs are sometimes drugs of abuse in CDCR/CCHCS.)
- Primary Care Provider (PCP) follow-up frequency will vary on case by case basis. Well-controlled patients may be seen at 180 day intervals.
- AED dosing is based primarily on side effects and seizure control, rather than AED levels.

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EVALUATION

New Onset Seizures (See page 3 for more details)

Diagnosis	Differential Diagnosis	Classification	Clinical Factors and Diagnosis
Epilepsy is a neurologic disorder characterized by recurring seizures (altered cerebral function due to excessive and abnormal electrical discharges of brain cells).	*Acute symptomatic or "provoked" seizures*: seizures which occur in the setting of stroke, traumatic brain injury, metabolic derangement (e.g., hypoglycemia, hyponatremia, drug/alcohol withdrawal, drug intoxication, medications, and encephalitis). Unless seizures recur they are not considered epilepsy. *Nonepileptic paroxysmal disorders*: syncope, psychological disorders, sleep disorders, paroxysmal movement disorders, migraine, miscellaneous neurologic events. In the elderly: transient ischemic attack (TIA), transient global amnesia, drop attacks.	• Identify seizure type(s) and/or epilepsy syndrome (see page 7). • Distinguish between focal or generalized seizures.	• Identify what happened before, during, and after the attack as well as any potential triggers. • EEG if epilepsy is suspected. • For new onset seizure, perform magnetic resonance imaging (MRI) of the head without and with contrast if epilepsy is suspected. • Computed tomography (CT) head without contrast is preferred in new-onset posttraumatic seizure, for urgent assessment, or when MRI is contraindicated. Evaluation cont'd on page 2

EVALUATION CONTINUED

ESTABLISHED SEIZURES			
History	Medication Review	Diagnostic Evaluation	AED Discontinuation and Withdrawal
• Obtain past medical history of seizures. Attempt to obtain pre-incarceration history and medical records. • Identify seizure type or description, number, and frequency of seizures. • Assess for changes in seizure control.	• Assess drug adherence: Failure to respond to usual AEDs should prompt a review of epilepsy diagnosis and adherence to medication(s). • Consider drug interactions when new medications are added, AEDs are added or changed, or seizure control changes. • Monitor for adverse effects/ toxicity, drug interactions, efficacy, and AED levels when indicated.	• EEG has limited use in management of chronic seizures/ epilepsy. • Consider EEG with changes in patient's seizure pattern or class or worsening mental status. • Neuroimaging: Perform emergently when a new focal deficit, persistent altered mental status, fever, acute head trauma, intractable headache, history of cancer, or suspected immune deficiency is present.	• Discontinuation of AEDs in patients with clearly established seizure disorders is not generally recommended due to the high risk of seizure recurrence, even after long seizure free intervals on therapy. • When discontinuation of AED is considered (e.g., for patient in whom epilepsy diagnosis is unclear or those who have been seizure free for two years), most schedules aim for a six to nine month taper, with dose reductions at three month intervals. More rapid tapers have been studied but are associated with higher rates of seizure recurrence.

SEIZURE TYPES

PSEUDOSEIZURES OR PSYCHOGENIC NONEPILEPTIC SEIZURES*

DEFINITION: Psychogenic nonepileptic seizures (PNES) are episodes of movement, sensation, or behaviors resembling epilepsy unaccompanied by physiologic central nervous system dysfunction.

DIAGNOSIS:

- Often misdiagnosed with epilepsy (epilepsy may also be present in 5-10% or more of PNES patients). More than 2/3rds of PNES patients are female.
- Diagnosis is based on a constellation of findings, the probability of PNES increases with the number of features unusual in epilepsy. Detailed history, physical examination, observation during seizures, and psychological evaluation are required for diagnosis.
- Video-electroencephalography (vEEG) is useful for diagnosis of PNES. Observation of typical seizures without accompanying EEG abnormalities is diagnostic.

FINDINGS SUGGESTIVE OF PNES

Clinical Features:

- Gradual onset of seizures
- Long seizure duration (2-3 minutes or more)
- Waxing and waning symptoms during seizure, nonphysiologic progression
- Disorganized, asymmetrical motor activity, side to side head movements, pelvic movements (especially thrusting), opisthotonos
- Eyes often closed, resistance to eye opening during seizure (highly suggestive of PNES)
- Ictal crying, weeping
- Seizures triggered by suggestion
- Rapid recovery after seizure, awake and oriented
- Rare incontinence, tongue biting on tip (not side of tongue)

Historical Features:

- High seizure frequency
- No response to AEDs or possibly increase in seizures with AED therapy.
- Associated psychiatric disorders
- History of sexual or physical abuse
- No history of injury from seizures
- Recurrent status epilepticus with frequent emergency room visits or hospitalizations
- Failure to respond to therapy for status epilepticus
- Seizures occur only when alone or only when others are present

TREATMENT OF PNES

► Thoughtful approach to informing patient of diagnosis ► Withdrawal of prescribed AEDs ► Treatment of underlying psychological disorders

NEW ONSET SEIZURE

Diagnostic evaluation of patients with first time seizures:

- Establish whether or not the event was a seizure. Obtain a complete description of the seizure including behaviors, movements, duration, level of consciousness, etc. (both ictal & postictal), from the patient and observers.
- Consider possible correctable systemic problems such as an acute medical condition (e.g., hypoglycemia, hyponatremia), syncope, arrhythmia, neurologic illness, or injury (e.g., TIA, stroke, TBI, movement disorder, meningitis, anoxic encephalopathy).
- Perform and document a complete physical and neurological examination.
- Labs: Obtain blood tests to identify abnormalities in electrolytes, glucose, calcium, magnesium, hepatic and renal function, and a toxicology screen when clinically indicated.
  - Depending on the clinical situation, a lumbar puncture may also be indicated to rule out infection, hemorrhage, etc.
  - Serum prolactin measurement*- Prolactin elevation (>2X baseline), measured 10 to 20 minutes after a suspected event, is a useful adjunct for the differentiation of generalized tonic–clonic or complex partial seizure from a psychogenic nonepileptic seizure but it is not sensitive enough to rule out epilepsy (i.e., does not distinguish an epileptic seizure from syncope).

*UpToDate: Psychogenic nonepileptic seizures, Alan B Ettinger, M.D. 12/16/2011

SEIZURE TYPES CONTINUED

NEW ONSET SEIZURE (continued)

- EEG: Perform an EEG if epilepsy is suspected. A Negative EEG does not rule out epilepsy.
  - When indicated, the EEG should be completed soon after the seizure (within 2 weeks).
  - Photic stimulation (to detect any light/visually triggered epileptic response) and hyperventilation should generally be part of the standard EEG assessment.
- Imaging: MRI should be performed if epilepsy is suspected. MRI with and without contrast is the modality of choice for brain imaging in most patients with epilepsy. CT has a role in the urgent assessment of seizures, or when MRI is contraindicated.

- Indications for referral/hospitalization at provider discretion:
  - Patients presenting with a first unprovoked seizure
  - Seizure characterized by a prolonged postictal state or incomplete recovery (status epilepticus)
  - Seizure associated with a systemic illness that may require evaluation and treatment
  - History of head trauma (loss of consciousness, retrograde/anterograde amnesia, mental status changes, vomiting)
- Seizure type: Seizure class and epilepsy syndrome are classified on clinical grounds, assisted by neurophysiologic and imaging studies. Seizure class has important implications in the choice of antiepileptic drugs (see Page 7).
- Medications: Carbamazepine, phenytoin, and valproic acid are all formulary medications and can all be regarded as first-line for all seizure types (see page 7).

POSTTRAUMATIC SEIZURES

- Seizures following TBI:
  - Older age (>65 years) is a risk factor for posttraumatic epilepsy.
  - The risk of posttraumatic epilepsy is slightly higher in women.
  - Neuroimaging (MRI or CT) is indicated in all patients with a new seizure after trauma.
- Early seizures (occurring within first week after TBI) commonly due to intracranial hematoma, depressed skull fracture, and/or severe injury:
  - 25% of early posttraumatic seizures occur within the first hour.
  - 50% of early posttraumatic seizures occur within the first 24 hours.
  - Although early seizures after TBI may not recur, patients are often treated with AEDs due to the risk of status epilepticus or aggravation of other injuries.
- Late seizures (occurring >1 week after TBI) are likely to represent epilepsy.
- Long term AED treatment is recommended after a first late posttraumatic seizure due to high rate of recurrence.
- Prophylactic AEDs are NOT recommended to prevent late seizures or posttraumatic epilepsy in patients who have NOT had a late posttraumatic seizure.
- The more severe the head injury, the longer the patient is at risk for late seizures.
- Approximately 80% of posttraumatic epilepsy develops within two years of a head injury.

STATUS EPILEPTICUS

- Status Epilepticus refers to the occurrence of a continuous unremitting clinical and/or electrographic seizure activity with a duration longer than five minutes, or recurrent seizure activity without recovery between seizures.
- Status epilepticus requires emergent, targeted treatment to reduce patient morbidity and mortality. Status epilepticus can lead to brain injury and must be treated without delay.
- Causes:
  - Non-adherence with AED treatment
  - Drug (alcohol, barbiturates, baclofen, and/or benzodiazepines) withdrawal syndromes
  - Brain injury from trauma, subarachnoid hemorrhage, tumors or cerebral metastases, stroke, infection, cerebral anoxia, or hypoxia
  - Metabolic disturbances (e.g., hypoglycemia, hepatic encephalopathy, uremia, pyridoxine deficiency, hyponatremia, hyperglycemia, hypocalcemia, hypomagnesemia)
- Prognosis: Depends most strongly on the underlying etiology and duration of the status.
- Recommended Therapy: (See algorithm on Page 6).

References

National Clinical Guideline Centre (NCGC). *The Epilepsies.* Clinical Guidelines. July 2010

American Academy of Neurology. *Use of serum prolactin in diagnosing epileptic seizures.* Neurology 2005; 65; 668

National Clinical Guideline Center (NCGC). *The Epilepsies.* Clinical Guidelines. July 2010

Guidelines for the Evaluation and Management of Status Epilepticus/Gretchen M. Brophy, et al - Neurocritical Care – 2012 – University of Pittsburgh]

Randolph W. Evans, MD. FAAN. *"Post-traumatic seizures and epilepsy."* UpToDate. Sept 24, 2010

UpToDate. Status Epilepticus in Adults "Recommendations of the Epilepsy Foundation of America's Working Group on Status Epilepticus." JAMA 1993, 270:854

SEIZURE TYPES CONTINUED

SUDDEN UNEXPECTED DEATH IN EPILEPSY (SUDEP)

- Defined specifically as the sudden, unexpected, witnessed or unwitnessed, nontraumatic, or nondrowning death in patients with epilepsy with or without evidence for a seizure, and excluding documented status epilepticus, in which autopsy does not reveal a structural or toxicological cause of death.

- SUDEP causes 2-18% of all deaths in patients with epilepsy and as high as 0.5-1% a year in those with refractory epilepsy. Noted risk factors:
  - Frequent convulsive seizures (>1/month)
  - Medication nonadherence
  - Subtherapeutic AED level
  - Age 20–45 years
  - Generalized tonic-clonic seizures
  - Polytherapy
  - Duration of epilepsy (>10 years)
  - Alcoholism
  - Male gender

  Possible etiologies suggested include:
  - Cardiogenic – ictal bradycardia and even asystole
  - Pulmonary – ventilator failure with ictal hypoxemia and hypercapnia
  - Primary neurologic – sudden, persistent cerebral electrical silence after a seizure

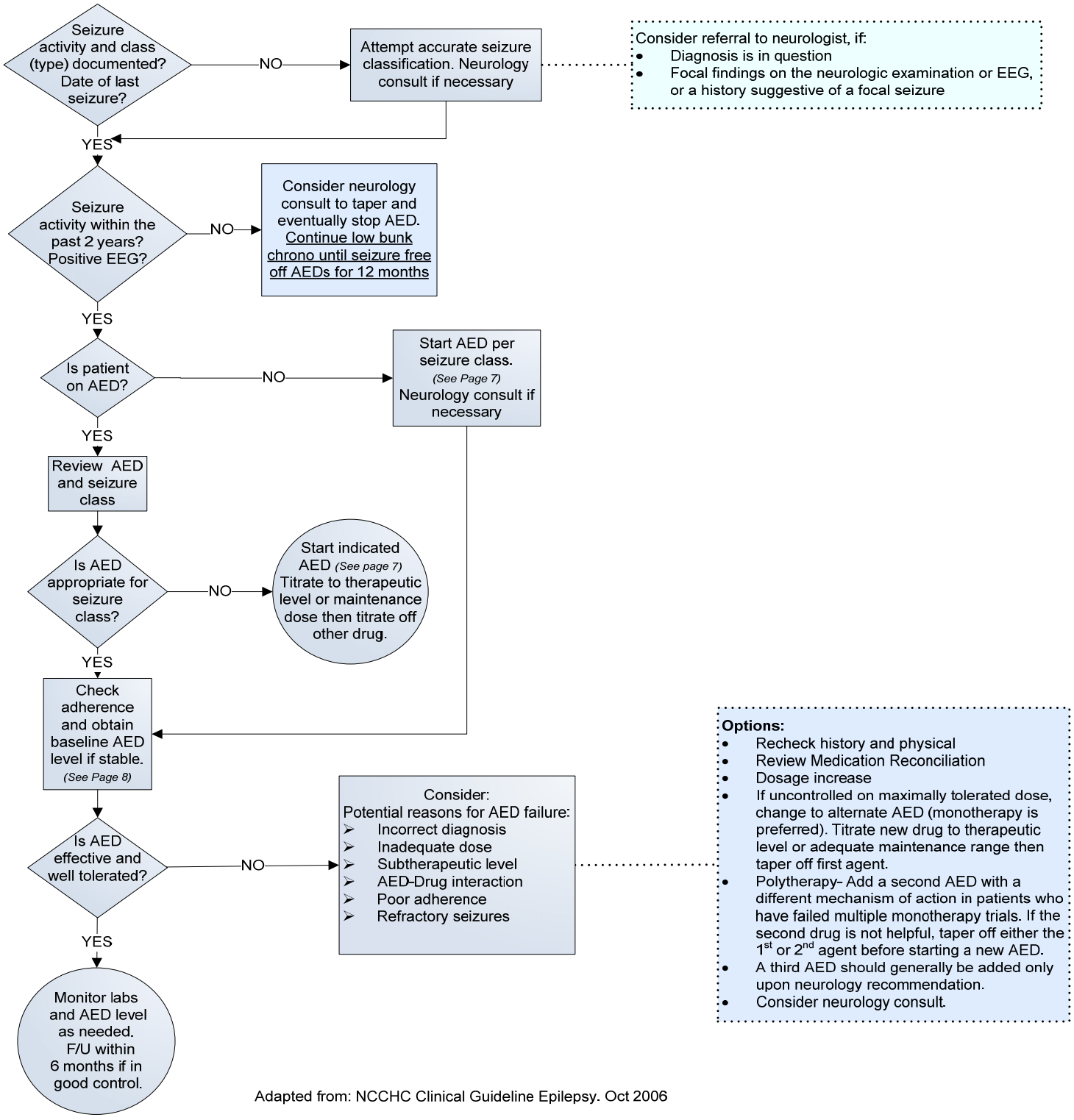
- Aggressive treatment of refractory epilepsy, including referral to a comprehensive epilepsy center and consideration of epilepsy surgery is appropriate in high risk patients.

The American Epilepsy Society and the Epilepsy Foundation have determined that information regarding the risk of SUDEP should be disclosed to all patients with a diagnosis of epilepsy as part of a comprehensive educational program.

EPILEPSY: CONTRACEPTION, PREGNANCY AND HORMONE REPLACEMENT THERAPY

- Preconception counseling is recommended to minimize risk of complications.
  - Be aware of established drug-drug interactions between AEDs and oral contraceptive therapy.
    - Contraceptive therapy failure may occur with AEDs, which are inducers of the cytochrome P-450 system.
- Folic acid supplementation (0.4 – 0.8 mg daily) is recommended for all women of child-bearing age to minimize the risk of neural tube defects.
  - Women taking AEDs (especially carbamazepine or valproic acid) are recommended to take 10 times the recommended dose of folate supplementation (4 mg daily) by the American College of Obstetrics and Gynecology.
  - AEDs are associated with major fetal malformations (e.g., neural tube defects) and impaired cognitive outcomes in newborns.
- Prenatal screening for patients being treated with AEDs is recommended.
  - Determine need for AEDs and minimize AED dosing during pregnancy, while still controlling seizures.
    - If possible, avoid valproate and multi-AED therapy during the first trimester of pregnancy to reduce the risk of major congenital malformations.
    - If possible, avoid phenytoin and phenobarbital during pregnancy to prevent cognitive impairment in newborn.
- Monitor both total and free plasma AED levels during pregnancy; (lamotrigine may need more frequent monitoring):
    - At 5-6 weeks, 10 weeks, and then at least once each trimester.
    - Also measure in the first or second week postpartum.
- Advise oral vitamin K supplementation (10 – 20 mg/day) in the last month of pregnancy for women taking enzyme-inducing AEDs (e.g., phenytoin, phenobarbital, topiramate, carbamazepine, oxcarbazepine).
- Breast-feeding is not contraindicated with AED therapy, though use of lamotrigine or sedating drugs may be exceptions.
- Among postmenopausal women, AED use is associated with greater bone density loss.

Patient Presenting with a History of Seizures



Adapted from: NCCHC Clinical Guideline Epilepsy. Oct 2006

CCHCS Care Guide: Seizure Disorders

ACUTE SEIZURE TRIAGE AND TREATMENT AREA MANAGEMENT

Immediate Action - First 5 Minutes

1. Take measures to avoid injury
2. ABC's - Protect/secure the airway
3. O_2 administration through nasal cannula
4. Monitor vital signs (blood pressure, pulse, respiratory rate, temperature, and O_2 Saturation)
5. Fingerstick glucose
6. Obtain history (patient, custody, nursing, others, chart)
7. Perform a neurological exam (check level of consciousness, weakness, hyperreflexia, Babinski sign, automatisms, focal asymmetric features)
8. Obtain venous sample for blood glucose, AED drug level (with clear clinical indications), CBC, chem panel

Single unremitting seizure lasting >5 minutes or recurrent seizure activity without full recovery between seizures?

NO →
1. Consider extra dose of current AED
2. Reevaluate AED therapy:
   - AED level and frequency of seizure activity
   - ↑ maintenance dose as needed
3. Monitor for at least 2 hours in TTA. Follow-up with PCP within 5 days or as clinically indicated

If postictal state persists

YES → Consider referral to higher level of care.

STATUS EPILEPTICUS MANAGEMENT

1. Notify PCP, Notify EMS for transport to higher level of care.
2. Maintain the airway, do not force anything through clenched teeth.
3. Loosen clothing, place patient in left lateral decubitus position, do not restrain patient.
4. Start O_2 at 2-6L/min via nasal cannula, place on Pulse Oximeter keep O_2 saturation >92%.
5. IV access (start with one, place additional one when time allows after treatment).
6 Administer 50 ml of 50% glucose and thiamine 100 mg IV if hypoglycemic or blood glucose level not available.
7. Administer: Lorazepam 2mg IV given slow IV push over 1 minute.
   a. Wait 1 minute for response.
   b. If continued seizure activity then give 2nd dose lorazepam 2 mg IV given slow IV push over 1 minute.
   c. Wait 5-10 minutes.
   d. If seizure activity continues give 3rd dose of lorazepam 2 mg IV given slow IV push over 1 minute.
   e. Wait 1 minute for response.
   f. If seizure activity continues give 4th dose of lorazepam 2 mg IV given slow IV push over 1 minute.
   (NOTE: Typically lorazepam 8 mg total dose is maximum–however for continued seizures see below*.)
   g. If no IV access give midazolam 10 mg IM one time (if weight >40 kg).
8. While waiting for transport, start second IV, draw blood for blood glucose, CBC, chem panel and AED level if indicated.
9. Monitor closely while awaiting transport.

Seizure persist?

NO → Patients with Episode of Status Epilepticus should be evaluated at hospital and AED levels checked and adjusted, or additional AED started.
Hospitalization likely if:
- Prolonged postictal state,
- Incomplete recovery,
- Systemic illness,
- Head trauma.

YES → Emergent transport to higher level of care

*If seizure activity continues after 8 mg of Lorazepam can consider additional doses- Per Up To Date "no definite maximum dose of lorazepam, clinicians to be guided by clinical effect (including on blood pressure) and seizure control." Watch for respiratory depression.

Reference: Up to Date Convulsive status epilepticus in adults: Treatment and prognosis Sept 2016

INTERNATIONAL CLASSIFICATION OF EPILEPTIC SEIZURES WITH TREATMENT RECOMMENDATIONS*

Major Class—Seizure	Subset of Class	Antiepileptic Drugs (Bold = Formulary)	
PARTIAL (FOCAL) SEIZURES	**Simple—Consciousness Not Impaired**	**Drugs of Choice**	**Alternatives**
	• Focal motor symptoms, without or with a Jacksonian march (e.g., twitching in a finger, advancing to the entire hand or limb), versive (version of the eyes and the head toward one side), postural (involuntary movements and posturing of the body), phonatory (incoherent speech and sounds) • Somatosensory or special sensory symptoms (visual, auditory, olfactory, gustatory, vertiginous) • Autonomic symptoms or signs (including epigastric discomfort, pallor, sweating, etc.)	Carbamazepine Phenytoin Lamotrigine Oxcarbazepine	Valproic acid Gabapentin Topiramate Levetiracetam Primidone Phenobarbital Pregabalin Felbamate
	Complex—Consciousness Impaired (most common type of seizure in epileptic adults)		
	• Simple partial - followed by impairment of consciousness • Impairment of consciousness/automatisms (involuntary motor activity). Behavior without conscious control (facial grimacing, gesturing, chewing, lip smacking, repeating phrases) • Psychic symptoms (disturbance of higher cerebral function). Usually occurs with impairment of consciousness and classified as complex partial. Dysphasic, cognitive, dysmnesic (e.g., déjà-vu), affective (e.g., fear), hallucinations		
GENERALIZED SEIZURES	**Absence (Non-Convulsive)** **(Petit Mal)**	**Drugs of Choice**	**Alternatives**
	• Typical— momentary break in consciousness of thought or activity, staring spells. Occur in childhood usually resolve in teen years. • Atypical—absence seizures with other seizure types (tonic, atonic, myoclonic). May persist for life.	Valproic Acid Ethosuximide	Lamotrigine Levetiracetam Zonisamide Clonazepam
	Myoclonic (Convulsive)	**Drugs of Choice**	**Alternatives**
	• Myoclonic— sudden brief shock-like contractions of one or more muscle groups, usually arms • Myoclonic Tonic—muscle stiffening, groaning and loss of consciousness • Myoclonic Atonic—without muscle stiffness	Phenytoin Valproic acid Carbamazepine	Lamotrigine Topiramate Oxcarbazepine Levetiracetam Primidone Phenobarbital
	Clonic (Jerking)		
	• Clonic seizures—rhythmic jerking movements of both arms, legs, neck, and face		
	Tonic (Stiffening)		
	• Tonic seizures—sudden muscle stiffness, often associated with impaired consciousness and falling to the ground		
	Tonic-Clonic (Grand Mal)		
	• Abrupt loss of consciousness with muscle stiffness/rigidity followed by rapid contraction and relaxation		
	Atonic		
	• Atonic ("drop attacks")—sudden spontaneous falls with complete recovery in seconds or minutes. No recognized loss of consciousness and the event is remembered		

*Seizures that cannot be clearly diagnosed into one of the preceding categories should be considered unclassified until further information allows their accurate diagnosis. International League Against Epilepsy-Classification—last revised 11/2010

Note that although there is evidence to support the use of these medications for these seizure types, the medication may not be indicated for this use by the United States Food and Drug Administration.

ANTIEPILEPTIC DRUGS:

The CCHCS pharmacy will switch from brand to generic medication unless "Do Not Substitute" and "Nonformulary" processes are followed. Note: The American Academy of Neurologists does not recommend automatic generic substitution of AEDs without physician's approval due to the variation allowed by the FDA between brand and generic medications. These small variations may have adverse effects for patients. However, generic substitution of AEDs may be appropriate with patient and physician approval.

- AEDs have many side effects and drug interactions. Important adverse effects and interactions are noted in this Care Guide. Refer to product information for full details for specific drugs.
- AEDs significantly interact with each other. Whenever an AED is added or removed from a treatment regimen, close monitoring for changes in efficacy or adverse effects of other AED agents is required.
- AEDs significantly interact with many other medications. Review of product information is important when adding or changing medication regimens.
- Anticonvulsants variably interact with many contraceptive medications. Refer to product information for full discussion. Alternate contraceptive methods are usually required.
- Therapy with anticonvulsants should not be abruptly discontinued to avoid rebound effects.
- Monitor for emergence or worsening of depression, suicidal thoughts or behavior, and/or unusual changes in mood or behavior.
- Monitoring of AED blood levels is often done inappropriately. In many cases, levels were obtained before steady state or without recording collection time. Furthermore, many levels were obtained without a clear medical indication. Levels are generally useful to monitor drug adherence or to identify an effective therapeutic level for a particular patient.

COMMON ANTIEPILEPTIC DRUGS: FORMULARY (LISTED ALPHABETICALLY BY GENERIC NAME)

MEDICATION	DOSAGE*	SIDE EFFECTS*	CONTRAINDICATIONS / COMMENTS*
Carbamazepine TEGRETOL® IR (Immediate release): 100 mg chewable tablet, 200 mg tablet Cost $	Indications: Partial seizures (simple or complex), generalized tonic-clonic seizures and mixed seizure patterns IR tablets: Initial Dose: 200 mg orally twice daily Titration: Increase dose weekly by 200 mg/day to max 1600 mg/day in divided doses, three to four times a day. Usual dose: 800 to 1200 mg/day. Max recommended dose: 1600 mg/day. Give with food Half-Life: 25-65 hours initial doses, 12-17 hours after repeated doses (3 to 5 weeks) due to autoinduction 100 mg chewable tabs — Only for half tablet dosing of carbamazepine 200 mg (100 mg dose). Do not use multiple tabs to make up higher doses.	Drowsiness, dizziness, blurred or double vision, lethargy, headache, nausea, vomiting, diarrhea, hyponatremia, agranulocytosis, ataxia, thrombocytopenia, increased LFTs, rash, pruritus, AV block Black Box Warnings Asian ancestry: Perform Human Leukocyte Antigen (HLA) B*1502 allele test prior to initiation for those of Asian ancestry. Those testing positive should not be treated unless benefit clearly outweighs risk. (Increased risk of development of Stevens Johnson syndrome or toxic epidermal necrolysis), monitor CBC, LFT's, and electrolytes periodically. Blood dyscrasias: Potentially fatal blood cell problems have occurred. Possibly increased risk in those with initially low wbc counts. Monitor CBC (baseline, every 12 weeks for 12 months, then annually). Drug interactions: Appropriate Use—be familiar with prescribing information, particularly regarding use with other drugs. (1) Level is decreased by enzyme-inducing drugs (e.g., phenytoin, phenobarbital, others). (2) Level is increased by many drugs, (e.g., erythromycin, propoxyphene, isoniazid, cimetidine, fluoxetine, others). (3) HCV drugs, HIV drugs, warfarin	Drug Levels Therapeutic: 4-12 mcg/ml Monitoring of levels not routinely indicated unless to assess adherence or suspected toxicity. Dosage of drug based on seizure control and side effects. Toxic levels: >15 mcg/ml Timing: Just before morning dose Time to steady state: >1 month Contraindications Hypersensitivity to drug/class/component. Hypersensitivity to TCAs. History of bone marrow suppression. Use with an MAOI, or use within 14 days of discontinuing a MAOI. Concomitant use of nefazodone or delavirdine or other nonnucleoside reverse transcriptase inhibitors . Renal Impairment Dose reduction not required. HD: Supplemental dose not needed. Hepatic Impairment Use with caution. Consider dose reduction. Pregnancy (D) Positive evidence of fetal risk. Lactation Probably safe. Usually compatible with breast-feeding per the American Academy of Pediatrics. Monitor infant for side effects.

Bold= Formulary

*See prescribing information for complete description of dosing, adverse effects and drug interactions.

COMMON ANTIEPILEPTIC DRUGS: FORMULARY (LISTED ALPHABETICALLY BY GENERIC NAME)

MEDICATION	DOSAGE FORMS*	SIDE EFFECTS*	CONTRAINDICATIONS / COMMENTS*
Lamotrigine LAMICTAL® IR (Immediate-release) Tablet: 25 mg, 100 mg, 150 mg, 200 mg Cost $	Indications: Partial seizures, Generalized tonic-clonic seizures, or Lennox-Gastaut seizures (Adjunctive) Adjunctive—(IR): Weeks 1-2: 25 mg/day; Weeks 3-4: 50 mg/day. Maintenance: Titrate dose to effect; after week 4, increase daily dose every 1-2 weeks by 50 mg/day. Usual maintenance dose: 225-375 mg/day in 2 divided doses. Adjustment for AED regimens containing valproate (IR): Weeks 1-2: 25 mg every other day; Weeks 3-4: 25 mg/day. Maintenance: Titrate dose to effect; after week 4, increase daily dose every 1-2 weeks by 25-50 mg/day. Usual maintenance dose: 100-400 mg/day in 1-2 divided doses. (Note: For patients taking lamotrigine with valproic acid alone, usual maintenance dose is 100-200 mg/day). Adjustment for enzyme-inducing AED regimens (e.g., carbamazepine, phenytoin, phenobarbital, primidone) without valproate (IR): Weeks 1-2: 50 mg/day; Weeks 3-4: 100 mg/day in 2 divided doses. Maintenance: titrate dose to effect; after week 4 increase daily dose every 1-2 weeks by 100 mg/day. Usual maintenance dose: 300-500 mg/day in 2 divided doses Half-Life: 12 - 59 hours	Rash, drowsiness, nausea, dizziness, ataxia, blurred vision, aplastic anemia, pancytopenia Black Box Warning Skin rashes which may be severe and potentially life-threatening have been reported; risk may be increased by coadministration with valproic acid. Drug interactions: (1) Level is increased by many drugs (e.g., valproic acid, others). (2) Level is decreased by enzyme-inducing drugs (e.g., phenytoin, carbamazepine, phenobarbital, others).	Drug Levels The value of monitoring plasma concentrations of lamotrigine has not been established. Contraindications Hypersensitivity to lamotrigine or any component of the formulation. Renal Impairment Use caution. Hepatic Impairment Mild impairment: No adjustment required. Moderate-to-severe impairment without ascites: Decrease doses by ~25%; adjust as clinically indicated. Moderate-to-severe impairment with ascites: Decrease doses by ~50%; adjust according to clinical response. Pregnancy (C) Lamotrigine has been found to decrease folate concentrations in animal studies. Lactation Enters breast milk; effects unknown.
Levetiracetam KEPPRA® IR (Immediate-release) Tablet: 250 mg, 500 mg, 750 mg, 1000 mg Cost $$$	Indications: Partial Seizures and Generalized Seizures (Alternative) Initial Dose (IR): 500 mg twice daily Titration (IR): Increase by 1000 mg/day every two weeks to 3000 mg/day Maintenance dose: 3000 mg/day Maximum dose: 3000 mg/day (1500 mg twice daily) Half-Life: 6-8 hours	Dizziness, headache, anorexia, vomiting, asthenia, abnormal behavior, irritability, psychosis, somnolence, fatigue, cough, ataxia, syncope, impaired coordination, vertigo, depression, diarrhea, diplopia. Rare severe reactions including toxic epidermal necrolysis and Stevens-Johnson syndrome. Drug interactions: Methotrexate, carbamazepine	Drug Levels No recommended target level and no clear correlation between trough and therapeutic response. Usual level associated with response 12-46 mcg/ml. Measurement useful to assess adherence. Contraindications Hypersensitivity to drug/class/component. There are no contraindications listed in manufacturer's labeling. Renal Impairment Dose adjustments are based on CrCl adjusted for body surface area (BSA) Adjust dose for CrCl <80 mL/min/1.73 m^2 HD: Dose adjustment needed. Hepatic Impairment No adjustment. Pregnancy (C) There are no adequate well-controlled studies in pregnant women . Lactation Not recommended.

BOLD= Formulary

*See prescribing information for complete description of dosing, adverse effects and drug interactions.

COMMON ANTIEPILEPTIC DRUGS: FORMULARY (LISTED ALPHABETICALLY BY GENERIC NAME)

MEDICATION	DOSAGE FORMS*	SIDE EFFECTS*	CONTRAINDICATIONS / COMMENTS*
Oxcarbazepine TRILEPTAL® IR (Immediate-release) Tablet: 150 mg, 300 mg, 600 mg Oral suspension: 300 mg/5ml Cost IR Tabs $$-$$$ Susp $$$$-$$$$$	Indications: Monotherapy or adjunctive therapy in the treatment of partial seizures Dosing: Initial: 300 mg twice daily Titration: Monotherapy (patients not receiving prior AEDs) - Increase dose every third day by 300 mg/day to a dose of 1200 mg/day in two divided doses. Dose may be increased up to 2400 mg/day to enhance efficacy as tolerated. Adjunctive therapy – Increase by a maximum of 600 mg/day at weekly intervals up to 1200 mg/day in two divided doses. Conversion to monotherapy – Initially: 300 mg twice daily while simultaneously reducing the dose of concomitant AEDs. Concomitant AEDs should be completely withdrawn over 3 -6 weeks, while the maximum dose of oxcarbazepine should be reached in about 2-4 weeks. Half-Life: 4-9 hrs	Dizziness, somnolence, headache, ataxia, fatigue, vertigo, abnormal gait, tremor, diplopia, nystagmus, abnormal vision, vomiting, nausea, abdominal pain, fatigue Hyponatremia: Clinically significant hyponatremia (sodium <125 mmol/L) can develop during use; monitor serum sodium, particularly during the first three months of therapy or in patients at risk for hyponatremia. Drug interactions: (1) Level is decreased by enzyme-inducing drugs (phenytoin, phenobarbital, verapamil, valproate). (2) May increase phenytoin and phenobarbital levels, may reduce efficacy of oral contraceptives and felodipine and other CCBs. (3) HCV drugs, HIV drugs, warfarin (4) Avoid alcohol due to increased sedative effects of combination. Important Note: Avoid use in patients with the genetic marker HLA-B*1502 allele as there is an increased risk for Stevens-Johnson syndrome or toxic epidermal necrolysis during treatment. Consider genotyping for HLA-B*1502 allele before starting therapy in patients with lineage to genetically at-risk populations	Drug Levels Monitoring drug levels is not generally indicated. Maximum dose is determined by side effects and/or adequacy of seizure control. Time to peak, serum: 4.5 hours (tablets) Contraindications Hypersensitivity to oxcarbazepine or any component of the formulation. Renal Impairment Adjust dose for CrCl <30 ml/min Hepatic Impairment No adjustment for mild to moderate impairment, no data in severe disease; use with caution. Pregnancy (C) There are no adequate clinical trials in pregnant women. Avoid as oxcarbazepine is similar to carbamazepine which is known to cause harm to fetus. Lactation Not recommended.
Phenytoin DILANTIN® Capsule ER (extended-release): 100 mg Oral suspension: 125 mg/5 ml Cost $$$	Indications: Generalized tonic-clonic (grand mal), complex partial seizures (psychomotor, temporal lobe), status epilepticus Capsule ER: Initial dose: 100 mg orally 3 times daily with dose adjustment at no less than 7-10 day intervals. Maintenance dose: 100 mg 3 times daily, up to 200 mg 3 times a day. May consider converting established patients on 100 mg 3 times a day to 300 mg ER once daily. Loading dose ER capsules: (excluding patients with renal or liver disease. Reserve for patients in a setting where phenytoin serum levels can be closely monitored) 1 gram divided into 3 doses (400, 300 and 300 mg) given orally at 2 hour intervals. Begin maintenance dosage 24 hours after loading dose. Oral Suspension: 125 mg 3 times daily then individualized up to 625 mg/day divided into 3 doses. Shake Well Before Use. Absorption impaired with continuous NG feeding. Dosage adjustment in obesity Use adjusted body weight (ABW) ABW = [(ABW – Ideal Body Weight (IBW)) x 1.33]+IBW. Maximum loading dose: 2000 mg Half-Life: Variable depending on dose and patient factors, 7-42 hours	Neurologic: ataxia, drowsiness, confusion, headache, insomnia, slurred speech, twitching, vertigo, Nystagmus Dermatologic: bullous dermatitis, morbilliform rash, Stevens-Johnson syndrome, Toxic epidermal necrolysis GI: constipation, dysgeusia, enlargement of lips, gingival hyperplasia, nausea, vomiting Hematologic: agranulocytosis, leucopenia, pancytopenia, thrombocytopenia, porphyria, dyscrasias Hepatic: hepatitis, liver failure Drug interactions: (1) Level is decreased by enzyme-inducing drugs (e.g., carbamazepine, phenobarbital, others). (2) Level is increased by many drugs (e.g., isoniazid, sulfonamides, fluoxetine, others). (3) HCV drugs, HIV drugs, warfarin	Drug Levels Therapeutic serum/plasma concentration: 10-20 mcg/ml (total), 1-2 mcg/ml (free); Note: Appropriate drug level is that which provides seizure control with acceptable side effects (may be <10 mcg/ml or >20 mcg/ml in some cases). Toxic Levels: Usually >20 mcg/ml (total), >2 mcg/mL (free) Timing: 24 hours after oral load, or just prior to next dose Time to Steady State: 7-10 days, highly variable Titration (after a loading dose) If rapid therapeutic levels needed, initial levels may be drawn within 24 hours (oral loading dose) to help determine maintenance dose or need to reload. Contraindications Hypersensitivity to phenytoin, other hydantoins, or any component of the formulation. Concomitant use with delavirdine or rilpivirine. Renal Impairment CrCl ≤10 ml/min—dosage adjustment and serum concentration monitoring may be necessary. Hepatic Impairment Patients with hepatic disease or impaired liver function may show early signs of toxicity. Monitor free phenytoin levels closely. Dosage adjustments may be necessary. Pregnancy (D) Positive evidence of fetal risk, but the benefits may be acceptable despite risk, if the drug is needed in a life-threatening situation. Lactation Excreted into breast milk. Breast-feeding is not recommended.

BOLD= Formulary

*See prescribing information for complete description of dosing, adverse effects and drug interactions.

COMMON ANTIEPILEPTIC DRUGS: FORMULARY (LISTED ALPHABETICALLY BY GENERIC NAME)

MEDICATION	DOSAGE FORMS*	SIDE EFFECTS*	CONTRAINDICATIONS / COMMENTS*
Valproic acid DEPAKENE® Capsule: 250 mg Oral solution: 250 mg/5ml Divalproex sodium DEPAKOTE® Tablet DR (delayed-release): 125mg, 250mg, 500 mg Tablet ER (extended-release): 250mg, 500mg Cost Valproic Acid Capsule $$ Solution $ Divalproex Sodium ER Tabs $$$ - $$$$$	Indications: Complex partial seizures: monotherapy or adjunctive therapy. Simple and complex absence seizures: monotherapy or adjunctive therapy. Drug of choice for absence Initial Oral Dose: Seizures: 10-15 mg/kg/day Administer doses >250 mg/day in divided doses (regular and delayed usually one to three times/day, ER, usually once daily) Titration: Increase by 5-10 mg/kg/day at weekly intervals until therapeutic levels are achieved; maintenance 30- 60 mg/kg/day Maximum dose: 60/mg/kg/day Swallow whole, take with a full glass of water. If needed, take with food to reduce GI effects. Half-Life: 9-16 hours	Significant: (>10%): headache, somnolence, dizziness, insomnia, nervousness, pain, alopecia, nausea, vomiting, diarrhea, abdominal pain, dyspepsia, anorexia, thrombocytopenia, diplopia, blurred vision, infection, flu-like syndrome Life threatening low incidence: Stevens Johnson syndrome, TEN, bone marrow suppression Black Box Warnings Hepatotoxicity Serious or fatal hepatotoxicity, usually occurring in the first 6 months of treatment, may be preceded by malaise, weakness, facial edema, anorexia and vomiting. Pregnancy teratogenic (weigh benefits/risks). Pancreatitis Life threatening, may occur at start of use or after many years. Drug interactions: (1) Level is decreased by enzyme-inducing drugs (phenytoin, phenobarbital, carbamazepine and others). (2) Level is increased by erythromycin, aspirin, amitriptyline. (3) Warfarin	Drug Levels Therapeutic: Epilepsy: 50-100 mcg/ml (valproic acid), seizure control may improve at levels >100 mcg/ml, some patients may experience control with higher or lower serum levels, but toxicity may occur at levels of 100-150 mg/ml. Monitor levels primarily for adherence. Dosage of drug based on seizure control and side effects. Toxic levels: >175 mcg/ml Contraindications Hypersensitivity to drug/class/component. Contraindicated with hepatic impairment, mitochondrial disorders and urea cycle disorders. Renal Impairment No adjustment needed in renal failure. Close monitoring of valproic acid serum concentrations may be warranted to ensure adequate dosage due to reduced protein binding. Hepatic Impairment Reduce dose with moderate liver impairment Contraindicated with severe liver disease. Close monitoring of valproic acid serum concentrations may be warranted to ensure adequate dosage due to reduced protein binding. Pregnancy (D) Do not administer to women who are pregnant or of childbearing age unless absolutely necessary. Positive evidence of fetal risk. Lactation Valproate is excreted in breast milk. Caution should be exercised when administered to a nursing woman. Of note, usually compatible with breast-feeding per the American Academy of Pediatrics.
OTHER ANTIEPILEPTIC DRUGS: NONFORMULARY (LISTED ALPHABETICALLY BY GENERIC NAME)			
Ethosuximide ZARONTIN® Capsule: 250 mg Oral syrup: 250 mg/5ml Cost $$$$$	Indications: Generalized seizures. Non-convulsive—Control of Absence (petit mal) epilepsy Initial Dose: 250 mg orally twice daily Titration: May increase by 250 mg/day as needed every 4 to 7 days until seizure control is achieved or to a Max daily dose of 1.5 g/day in divided doses. Half-Life: 50-60 hours (adults)	Aggressiveness, ataxia, concentration impaired, dizziness, drowsiness, euphoria, fatigue, headache, hyperactivity, inability to concentrate, irritability, lethargy, hirsutism, urticaria, increased libido, abdominal pain, anorexia, cramps, diarrhea, epigastric pain, hematuria (microscopic), vaginal bleeding, myopia, hiccups Warnings/Precautions: Blood dyscrasias. Monitor blood counts periodically, especially if signs/symptoms of infection develop. Associated with cases of SLE. Stevens-Johnson Syndrome. Avoid ethanol. Drug Interactions: Ethosuximide may elevate phenytoin serum levels. Valproic acid has been reported to both increase and decrease ethosuximide levels. CYP3A4 Inducers (Strong): May increase the metabolism of CYP3A4 Substrates while CYP3A4 Inhibitors (Strong): May decrease the metabolism of CYP3A4 Substrates.	Drug Levels Therapeutic:40-100 mcg/ml Toxic levels: >150 mcg/ml. Monitor levels primarily for adherence. Dosage of drug based on seizure control and side effects. Contraindications History of hypersensitivity to succinimides. Renal Impairment Use with caution, no dosage adjustment is necessary. HD: Give dose after dialysis. PD: No adjustment, no supplement. Periodic urinalysis is advised for all patients with renal disease. Hepatic Impairment: Use with caution. Periodic liver function tests are advised for all patients with liver disease. Pregnancy (C) Safe use has not been established, however, other anticonvulsants have been associated with adverse teratogenic effects. Lactation Excreted in breast milk. Should be used during breast-feeding only if the benefits clearly outweigh the potential risks.

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OTHER ANTIEPILEPTIC DRUGS: NONFORMULARY (LISTED ALPHABETICALLY BY GENERIC NAME)

MEDICATION	DOSAGE FORMS*	SIDE EFFECTS*	CONTRAINDICATIONS / COMMENTS*
Felbamate FELBATOL® Tablet: 400 mg, 600 mg Suspension: 600 mg/5ml Cost $$$$	Indications: Not a first line antiepileptic. Partial seizure, with and without generalization; Lennox-Gastaut seizures Initial dose monotherapy 1200 mg/day in 3 to 4 divided doses Titration: The dose may be increased under close clinical supervision, in 600 mg increments every two weeks to 2400 mg/day based on response. If clinically necessary, may increase dose to 3600 mg/day. Half-Life: 20 hours Best absorbed on empty stomach. NA/DOT	CNS: Somnolence, headache, fever, dizziness, insomnia, fatigue, nervousness. GI: vomiting, nausea, constipation, dyspepsia. Suicidal ideation, nervousness, abnormal thinking, emotional lability, ataxia, depression, anxiety, stupor, malaise, agitation, psychological disturbances, aggressive reaction, euphoria. Chest pain, facial edema, palpitation, tachycardia. Stevens-Johnson syndrome, acne, Aplastic anemia, urticaria. Hypophosphatemia, intramenstrual bleeding, hypokalemia, hyponatremia Black Box Warnings: Felbamate is associated with a marked increase in the incidence of aplastic Anemia. Hepatic Failure: Evaluation of postmarketing experience suggests that acute liver failure is associated with the use of felbamate. Measure AST/ALT, CBC, bilirubin before and during therapy. Drug Interactions: Increases levels of phenytoin, valproic acid, phenobarbital, active carbamazepine metabolite.	Therapeutic Drug Levels Monitoring of levels not indicated, dose is titrated to clinical response. Time to peak, serum: 3-5 hours Contraindications Hypersensitivity to felbamate, or any component of the formulation; or known sensitivity to other carbamates; history of blood dyscrasia; History of hepatic dysfunction. Renal Impairment Dosage adjustments are recommended. Decrease starting and maintenance doses by 50% in renally impaired patients HD: Dose after dialysis, no supplement. PD: No supplement. Hepatic Impairment—Contraindicated Felbamate should not be used in patients with a history of hepatic impairment . Pregnancy (C) There are no adequate well-controlled studies in pregnant women. Felbamate may be used during pregnancy only if clearly needed. Lactation Felbamate is excreted in breast milk. Until additional data is available, breast-feeding is not recommended.
Gabapentin NEURONTIN® IR (Immediate Release) Capsule: 100 mg, 300 mg, 400 mg IR (Immediate Release) Tablet: 600 mg, 800 mg Cost $$	Indications: Partial Seizures (Adjunctive—Not monotherapy) Initial (IR): 300 mg 3 times daily Titration (IR): Increase dosage based on response and tolerability. Usual dose: 300-600 mg 3 times daily Maximum dose for seizures: doses up to 2400 mg/day have been well tolerated. Half-Life: 5-7 hours Must be NA/DOT and crushed/ floated	Dizziness, somnolence, ataxia, fatigue, GI upset, peripheral edema. Dermatologic reactions including erythema multiforme, Stevens-Johnson syndrome, rash with eosinophilia Drug interactions: Potentiates CNS depressants.	Drug Levels Not necessary. Contraindications Hypersensitivity to drug/class/ component. Renal Impairment Adjust dose for CrCl <60 ml/min Hepatic Impairment No adjustment. Pregnancy (C) There are no adequate well-controlled studies in pregnant women. Lactation Enters breast milk; effects unknown.
Phenobarbital LUMINAL® Tablet: 15 mg, 30 mg, 60 mg, 100 mg Cost $$	Indications: Generalized and partial seizures (Alternative) Dosing: 50-100 mg two to three times daily Half-Life: 50 - 120 hours NA/DOT	CNS excitation or depression, respiratory depression. Bradycardia, hypotension, syncope, agitation, anxiety, ataxia, confusion, dizziness, drowsiness, hallucinations, "hangover" effect, headache, hyperkinesia, impaired judgment, insomnia, lethargy, nervousness, nightmares, somnolence. Exfoliative dermatitis, rash, Stevens-Johnson syndrome. Nausea, vomiting, constipation, agranulocytosis, thrombocytopenia, megaloblastic anemia Drug interactions: Azoles, protease inhibitors. Level is increased by valproic acid, phenytoin, clarithromycin, other drugs. Potentiates effects of alcohol or other sedatives. May decrease levels of phenytoin, oxcarbazepine, lamotrigine, warfarin, HCV drugs, HIV drugs	Drug levels Therapeutic: 10-40 mcg/ml Toxic: > 40 mcg/ml. Monitor levels primarily for adherence. Dosage of drug based on seizure control and side effects. Contraindications Hypersensitivity to barbiturates or any component of the formulation; marked hepatic impairment; dyspnea or airway obstruction; porphyria. Renal Impairment Adjust dose for CrCl <10 ml/min Hepatic Impairment Dose reduction recommended. Pregnancy (D) Positive evidence of risk to fetus. Lactation Small amounts excreted into breast milk. Use with caution per American Academy of Pediatrics. Avoid use in geriatric patients

BOLD= Formulary

*See prescribing information for complete description of dosing, adverse effects and drug interactions.

OTHER ANTIEPILEPTIC DRUGS: NONFORMULARY (LISTED ALPHABETICALLY BY GENERIC NAME)

MEDICATION	DOSAGE FORMS*	SIDE EFFECTS*	CONTRAINDICATIONS / COMMENTS*
Pregabalin LYRICA® Capsule: 25 mg, 50 mg, 75 mg, 100 mg, 150 mg, 200 mg, 225 mg, 300 mg Cost $$$$$	Indications: Partial seizures (adjunctive therapy) Dosing: Initial: 150 mg per day in divided doses (75 mg two times a day or 50 mg three times a day) Titration: Dose may be increased based on tolerability and effect Maximum dose: 600 mg/day Administered with or without food. Half-Life: 6 hours	Peripheral edema, dizziness, somnolence, ataxia, headache, tremor, blurred vision, diplopia, weight gain, xerostomia, infection, accidental injury Drug interactions: No known significant interactions.	Drug levels No data for efficacy of drug level monitoring. Dosage of drug based on efficacy and side effects. Contraindications Hypersensitivity to pregabalin or any component of the formulation. Renal Impairment Adjust dose for CrCl ≤60 ml/min Hepatic Impairment No adjustment. Pregnancy There are no adequate clinical trials in pregnant women. Lactation Not recommended.
Primidone MYSOLINE® Tablet: 50 mg, 250 mg Cost $$ - $$$	Indications: Partial and generalized tonic-clonic seizures (Alternative) Dosing: No previous treatment Initial: Days 1-3: 100-125 mg at bedtime Titration: Days 4-6: 100-125 mg twice daily Days 7-9: 100-125 mg 3 times daily Day 10 to maintenance: 250 mg 3 times daily Usual dose: 250 mg 3-4 times daily Maximum dose: 2 g/day Receiving other anticonvulsants Initial: 100-125 mg at bedtime and gradually increased as other drug is gradually decreased; continue until satisfactory dosage level achieved for the combination or the other medication is completely discontinued Administer with food to minimize GI irritation Half-Life: 3-23 hours, phenobarbital is active metabolite– half life 75-126 hours	Ataxia, drowsiness, emotional disturbances, fatigue, hyperirritability, morbilliform skin eruptions, anorexia, nausea, vomiting, impotence, agranulocytosis, granulocytopenia, megaloblastic anemia (idiosyncratic), red cell aplasia/hypoplasia, diplopia, nystagmus Drug interactions: (1) Level is increased by valproic acid and phenytoin. (2) May reduce levels of HCV drugs, HIV drugs, warfarin.	Metabolized to phenytoin Drug Levels Therapeutic: 5-12 mcg/ml. Must measure both primidone and phenobarbital levels. Primidone at steady state in 2 days, phenobarbital in 20 days. Time to peak serum: ~3 hours (variable) Contraindications Hypersensitivity to primidone or any component of the formulation. Hypersensitivity to phenobarbital; porphyria. Renal Impairment Adjust dosing interval for CrCl ≤50 ml/min. Avoid in renal failure if possible. Hepatic Impairment Monitor plasma levels and adjust dose accordingly. Pregnancy (D) Positive evidence of risk to fetus. Lactation Not recommended.
Topiramate TOPAMAX® IR (Immediate Release) Tablet: 25 mg, 50 mg, 100 mg, 200 mg Capsule (IR sprinkles): 15 mg, 25 mg Cost $ - $$$	Indications: Generalized tonic-clonic seizure and partial seizures (monotherapy or adjunctive) Initial Dose: 25 mg twice daily Titration: Increase at weekly intervals by 25-50 mg/day (daily dose given in two divided doses-use slow titration ration rate when used as adjunctive therapy) until response Usual dose: 100-200 mg twice daily. Maximum dose: 400 mg/day Half-Life: 21 hours	Somnolence, dizziness, nervousness, ataxia, psychomotor slowing, speech problems, memory difficulties, behavior problems, confusion, difficulty concentrating, nystagmus, metabolic acidosis, Stevens-Johnson syndrome, toxic epidermal necrolysis, weight loss, depression, fatigue, hyperthermia (severe), hepatotoxicity Drug interactions: Level is decreased by enzyme-inducing drugs (phenytoin, carbamazepine, phenobarbital).	Drug Levels Monitoring of levels not indicated, dose is titrated to clinical response. Time to peak serum: 1-4 hours Contraindications Hypersensitivity to drug/component. Renal Impairment Reduce dose with CrCl <70 ml/min Hepatic Impairment Use with caution. Pregnancy (D) Use during pregnancy can cause cleft lip and/or palate. Lactation Enters breast milk, use caution.

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*See prescribing information for complete description of dosing, adverse effects and drug interactions.

ACUTE SEIZURE DRUGS:

MEDICATION	DOSAGE FORMS*	SIDE EFFECTS*	CONTRAINDICATIONS / COMMENTS*
Lorazepam ATIVAN® Injectable solution: 2 mg/ml Cost $	Indications: Status epilepticus Status epilepticus: IV: Lorazepam 2mg IV given slow IV push over 1 minute Wait 1 minute for response. If continued seizure activity then give 2nd dose lorazepam 2 mg IV given slow IV push over 1 minute. Wait 5-10 minutes, If seizure activity continues, give 3rd dose of lorazepam 2 mg IV given slow IV push over 1 minute. Wait 1 minute for response. If seizure activity continues, give 4th dose of lorazepam 2 mg IV given slow IV push over 1 minute. Usual maximum dose: 8 mg** Note: Monitor for possible circulatory and respiratory depression. Use with caution in debilitated/elderly patients. NA/DOT	CNS: Akathisia, amnesia, ataxia, confusion, depression, disorientation, dizziness, headache, visual disturbances, weakness. Respiratory depression, nausea. hypotension Drug Interactions: Potentiates other CNS depressants including alcohol. Increases levels of Phenytoin.	Drug Levels Monitoring of levels not indicated, dose is titrated to clinical response. Contraindications Hypersensitivity to lorazepam or any component of the formulation (cross-sensitivity with other benzodiazepines may exist); sleep apnea or severe respiratory failure; acute narrow angle glaucoma (dilates pupils). Renal Impairment Possible risk of propylene glycol toxicity with IV use. Hepatic Impairment Use cautiously. Avoid use in hepatic failure. Pregnancy (D) Positive evidence of risk to fetus. Lactation Not recommended.
Midazolam VERSED® Injectable Solution: 5 mg/ml Cost $	Indications: Status epilepticus Dose: Status epilepticus: 10 mg IM once (if weight > 40 kg) Note: Use with caution in debilitated/ elderly patients	Common Reactions: sedation, nausea, vomiting, injection site pain, hiccups, hypotension, agitation, dystonia, amnesia, diplopia, disinhibition, confusion, ataxia, weakness, dysarthria, euphoria, rash Serious Reactions: respiratory depression, apnea, respiratory failure, cardiac arrest, hypotension, bradycardia, tachycardia, syncope, seizures, CNS stimulation, paradoxical dependency, abuse bronchospasm anaphylaxis/ anaphylactoid reaction, withdrawal sx if abrupt D/C	Contraindications Hypersensitivity to drug/class. Renal Impairment Caution if renal impairment. Hepatic Impairment Caution if hepatic impairment. Pregnancy Consider alternative during pregnancy; possible risk of teratogenicity based on conflicting human data with other benzodiazepines. Lactation Safety conditional; safety may vary with different populations or dosing.

BOLD= Formulary

*See prescribing information for complete description of dosing, adverse effects and drug interactions .

**There is no definite maximum dose of lorazepam; clinicians should be guided by the clinical effect (including on blood pressure and respiratory depression) and seizure control.

Reference: Guidelines for the Evaluation and Management of Status Epilepticus/Gretchen M. Brophy, et al - Neurocritical Care-2012-University of Pittsburgh

PATIENT EDUCATION/SELF MANAGEMENT

SEIZURE DISORDER: WHAT YOU SHOULD KNOW

What is a Seizure?

- A seizure happens when nerve signals in the brain are not working right.

What causes seizures?

A seizure can happen for many reasons. You may have a seizure if you:

- Hurt your head
- Had a brain injury at birth
- Have a brain infection or a tumor
- Have a stroke
- Have been abusing drugs
- Suddenly stop using a substance you are addicted to, like alcohol or drugs
- Your blood sugar is too low

How are seizures treated?

- The right treatment for seizures depends on what causes them
- Treatment for seizures is different for each person
- If you have more than one seizure you may need anti-seizure medicines
- You may need to try different medicines before health care staff finds a treatment that works well
- Your primary care provider may need to make many changes to your medication to control your seizures

Can people die from having a seizure disorder?

Most people who have seizures live a full life span. However, there are some things about living with seizure disorder that can increase the risk of early death which include:

- Accidents such as drowning, burning, choking, or falling during a seizure
- People with a seizure disorder may have more risk for depression and suicide
- Very long seizures or many seizures that happen one after another (called status epilepticus), can be life-threatening
- Very rarely, people with a seizure disorder may die suddenly, without explanation

Good seizure control and use of safety measures can reduce the risk of seizure related death

How Can I Take Care of Myself?

- ✓ Take your prescribed medication regularly, the way your primary care provider ordered
- ✓ Do not start taking any other medications, including over-the-counter and herbal supplements, without checking with your primary care provider first
- ✓ Keep a record of seizures as they occur
- ✓ Stay away from alcohol, illegal drugs, and medications not prescribed for you
- ✓ Avoid activities that have a risk of head injuries, such as climbing ladders or contact sports
- ✓ Stay away from jobs that could put you in danger
- ✓ See your primary care provider regularly as scheduled

At your housing area, work or school:

- ✓ Tell your "cellie", friends, boss, or teacher(s) at school that you may have a seizure
- ✓ Let them know what to do if one happens

What Other People Should do if You Have a Seizure

- Help you lie down on a bed or the floor
- Loosen the clothes around your neck and take off eyeglasses
- Check to make sure you are breathing
- Turn you on your side if you start to throw up
- Move you only if needed to keep you from getting hurt (for example, by hitting furniture)

People who are helping you should NOT**:**

- Try to hold you down
- Put anything in your mouth while you are having a seizure

For Women: What if I am pregnant?

- Some anti-seizure medicines can affect the health of your baby. You should tell your primary care provider right away if you are pregnant
- Anti-seizure medicine can lessen the effects of some birth control methods
- If you are of child-bearing age, you should talk to your primary care provider about your plans for pregnancy

EDUCACIÓN PARA EL PACIENTE/CONTROL PERSONAL DEL CASO

TRASTORNO CONVULSIVO: LO QUE DEBE SABER

¿Qué es una convulsión?

- Una convulsión sucede cuando las señales nerviosas en el cerebro no funcionan correctamente.

¿Qué es lo que causa las convulsiones?

Una convulsión puede ocurrir por muchas razones. Es posible que tenga una convulsión si:

- Se lastima la cabeza.
- Tuvo una lesión cerebral al nacer.
- Tiene una infección o tumor cerebral.
- Tiene un derrame cerebral.
- Ha estado abusando de las drogas.
- De repente deja de usar una sustancia a la cual Ud. es adicto, como el alcohol o las drogas.
- Su nivel de azúcar en la sangre es demasiado bajo.

¿Cómo se tratan las convulsiones?

- El tratamiento correcto para las convulsiones depende de lo qué las causa.
- El tratamiento para las convulsiones es diferente para cada persona.
- Si tiene más de una convulsión, es posible que necesite tomar medicamentos anticonvulsivos.
- Es posible que tenga que probar diferentes medicamentos antes de que el personal de atención médica encuentre un tratamiento que funcione bien.
- Su médico de atención primaria podría tener que realizar muchos cambios en su medicación para controlar sus convulsiones.

¿El trastorno convulsivo puede ocasionar la muerte?

La mayoría de las personas que tienen convulsiones viven una vida plena. Sin embargo, hay algunos aspectos relacionados con el hecho de vivir con un trastorno convulsivo que pueden aumentar el riesgo de muerte prematura, los cuales incluyen:

- Accidentes, tales como ahogamiento, quemaduras, asfixia o caídas durante una convulsión.
- Las personas con un trastorno convulsivo podrían tener mayor riesgo de depresión y suicidio.
- Tener convulsiones muy largas o muchas convulsiones consecutivas (conocido como estatus epiléptico) puede poner en peligro la vida.
- En muy raras ocasiones, las personas con un trastorno convulsivo pueden morir repentinamente sin ninguna razón aparente.

Tener un buen control de la convulsión y poner en práctica las medidas de seguridad puede reducir el riesgo de convulsiones relacionadas con la muerte.

¿Cómo puedo cuidarme?

- ✓ Tome regularmente los medicamentos recetados de la forma en que su médico de atención primaria le indicó.
- ✓ No comience a tomar ningún otro medicamento, incluidos los suplementos sin prescripción y los naturales, sin verificar primero con su médico de atención primaria.
- ✓ Mantenga un registro de las convulsiones a medida que ocurran.
- ✓ No consuma alcohol, drogas ilegales y medicamentos que no se le prescribieron.
- ✓ Evite las actividades que impliquen riesgo de lastimarse la cabeza, tales como subirse a escaleras o realizar deportes de contacto.
- ✓ No realice trabajos que podrían ponerlo en peligro.
- ✓ Consulte con su médico de atención primaria regularmente, según lo programado.

En su lugar de residencia, trabajo o estudio:

- ✓ Dígale a su compañero(a) de celda, a sus amigos, a su jefe o profesor(es) que podría tener una convulsión.
- ✓ Indíqueles qué deben hacer si tiene una convulsión.

Lo que deben hacer las otras personas si usted tiene una convulsión

- Ayudarlo a acostarse en una cama o en el suelo.
- Aflojar las prendas de vestir alrededor de su cuello y quitarle los anteojos.
- Asegurarse de que está respirando.
- Ponerlo de costado si comienza a vomitar.
- Moverlo únicamente si es necesario para evitar que se lastime (por ejemplo, al golpear un mueble).

Las personas que lo están ayudando NO deberían:

- Tratar de sujetarlo.
- Colocar algo en su boca mientras convulsiona.

Para las mujeres: ¿qué pasa si estoy embarazada?

- Algunos medicamentos anticonvulsivos pueden afectar la salud de su bebé. Debería informarle inmediatamente a su médico de atención primaria si está embarazada.
- Los medicamentos anticonvulsivos pueden disminuir los efectos de algunos métodos anticonceptivos.
- Si se encuentra en edad fértil, le recomendamos que hable con su médico de atención primaria sobre sus planes de embarazo.