The Evaluation and Management of Seizures

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Introduction

- Evaluating a single seizure
- The epidemiology of epilepsy
- Seizure classification
- Treatment options
  - traditional antiepileptic drugs (AEDs)
  - newer AEDs

Historical Overview:
Epilepsy Prevention and Cure

<table>
<thead>
<tr>
<th>Year</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1912</td>
<td>Institutionalize and stigmatize</td>
</tr>
<tr>
<td>1980s</td>
<td>Prevent seizures</td>
</tr>
<tr>
<td>2002</td>
<td>Minimize consequences</td>
</tr>
<tr>
<td></td>
<td>Prevent epilepsy</td>
</tr>
<tr>
<td></td>
<td>Cure epilepsy</td>
</tr>
</tbody>
</table>

Definitions

- Seizure: the clinical manifestation of an abnormal and excessive excitation of a population of cortical neurons
- Epilepsy: recurrent unprovoked seizures

Diagnosis/Etiology:
When in Doubt, Check it Out

- Does the patient have epilepsy? Differentiate:
  - Epileptic seizure: stereotyped and nonprovoked
  - Syncope: visual change, pallor, diaphoresis, slump, rapid recovery unless convulsive syncope
  - Psychogenic event: nonstereotyped, bilateral convulsions without loss of consciousness, pauses, normal EEG may represent 20 to 30% of referrals to epilepsy clinics
- Are seizures due to active brain disorder?
  - tumor
  - infection
  - metabolic disease

Questions Raised by a First Seizure

- Seizure or not?
- Focal onset?
- Evidence of CNS dysfunction?
- Identifiable precipitant?
- Seizure type? Syndrome type?
- Studies?
- Start antiepileptic drug (AED)?
Diagnosis of Seizures

Potential diagnosis of seizures

Seizures

Acute cause?

Yes

Acute symptomatic

Febrile convulsions

No

Unprovoked

Only one

Solitary seizure

More than one

Epilepsy

Evaluating a spell

Ask

Tell me what happened from start to finish

Was there weakness? Numbness? Trouble speaking? Alteration of consciousness?

Did anyone else see it? What did they see?

What were the warning symptoms?

Did you pass out?

If so, were you confused when you came to?

How long did it last?

Was there incontinence or tongue biting?

Ask (con’t)

Has anything like this ever happened before?

Have you ever had a seizure? A stroke?

Associated with the spell, did you have chest discomfort? Racing or irregular heartbeat? Nausea? Diaphoresis?

Don’t forget to ask about…

Alcohol

Diabetes

Family history

History of trauma

Stress/psychological factors

Any other factors the patient feels may have contributed to the event

As you listen, try to figure out if it sounds more like:

– A seizure

– A TIA or stroke

– A cardiac arrhythmia

– A panic attack

– Vasovagal syncope

– A provoked spell due to alcohol, hypoglycemia, etc.
Exam

• Do the whole neuro exam
• Listen to heart and lungs
• Listen for carotid bruits
• If you suspect vasovagal event, check lying & standing pulse rates

Plan for suspected seizures...

• Blood tests
  – electrolytes, CBC
  – toxic screen, alcohol screen
  – medication levels
  – Possible ABG or O2 sat
• EEG
• Brain imaging—MRI is preferred
• If there is any suspicion of infection, consider LP
• If seizure was provoked, address underlying provoking factors.
• If seizures are unprovoked and recur, consider treatment with an antiepileptic drug
• No driving!

Seizures That May Not Require Treatment

• Single seizure
• Febrile seizure
• Idiopathic localization-related seizures of childhood
• Benign familial seizures of childhood
• Simple partial seizure
• Post-traumatic impact seizures
  – occurring within minutes of trauma
• Provoked seizures
  – alcohol withdrawal

Risk Factors for Seizure Recurrence After First Seizure

• If idiopathic—only 17% had recurrence at 20 months
  – 26% by 36 months
• If idiopathic with spike-wave on EEG—risk 50% at 18 months
• If idiopathic with sibling with seizure—risk 35% at 4 months
• Age at first seizure and onset with status epilepticus are not risk factors

Factors That Increase Risk for Seizure Recurrence

• Prior neurologic insult most powerful predictor
• Abnormal EEG
• Prior seizures, including complex febrile seizure
• Postictal paralysis
• Partial seizure

Epidemiology

Prevalence and Incidence in the United States
- 2.5 million persons with epilepsy
- 70,000-128,000 new cases annually
- Cumulative adjusted lifetime risk: 1.3%-3.1%


Consequences of Epilepsy and Its Treatment: Injury and Death
- Risk of injury is increased in people with epilepsy-5% annual rate of Emergency Dept. care due to seizure related injuries
  - burns
  - head injuries
  - falls
  - drownings
  - fractures
  - may be amplified by medications causing ataxia, drowsiness, or dizziness
- Increased risk of death
  - higher in patients with seizures
  - related to poor seizure control

Epilepsy-Related Financial Cost
- Average treatment-related costs of each new diagnosis (1995 dollars)
  - during first 3 months $ 2,642
  - during year 6 $ 329
  - total over 6 years $ 6,429
- High cost at onset due to diagnosis and initial treatment
- Decline in cost partly due to remission and AED discontinuation
- Highest costs for patients with intractable epilepsy

Epilepsy Incidence: 1935 – 1984

Etiology of Epilepsy
- Infection 3%
- Stroke 8%
- Mental retardation/Cerebral palsy 15%
- Degenerative – 4%
- Other – 1%
- Trauma – 4%
- Tumor – 3%
- Unknowns 62%

Common Etiologies of Seizures Change With Age
- Children
  - febrile seizures
  - congenital causes
  - metabolic causes
- Young adults
  - trauma
  - tumor
- Elderly
  - stroke
  - degenerative changes
Classification of Seizure Types

Seizure Types

- Single
- Recurrent
- Nonepileptic
  - Syncope
  - Migraine
  - Psychogenic
  - Toxic
  - Cerebrovascular
  - Metabolic
- Epileptic
  - Generalized
    - Absence
    - Tonic-clonic
    - Tonic
    - Myoclonic
    - Atonic
  - Partial
    - Simple
    - Complex
  - Secondarily Generalized

International League Against Epilepsy: Seizure Classification (1981)

- Currently used seizure classification scheme based upon mode of seizure onset
  - partial: starts in one region of a hemisphere
  - generalized: starts in both hemispheres simultaneously
- Distinction between partial and generalized seizures
  - clinical phenomena
  - ictal and interictal electroencephalograms

International League Against Epilepsy: Revised Classification of Epileptic Seizures (1981)

- Partial (focal, local) seizures
  - simple: motor, autonomic, psychological, somatosensory or special sensory—no alteration in awareness
  - complex:± automatisms—has alteration in awareness
  - secondarily generalized tonic-clonic—also called grand mal or convulsive seizure
- Generalized seizures
  - absence:± clonic, tonic, autonomic, automatic
  - atypical absence: changes in postural tone
  - clonic
  - tonic-clonic
  - myoclonic
  - atonic

Diagnosis of Seizure Type(s)

- Grand mal and petit mal seizures
  - these are old terms and may no longer be useful for classification
- Patient has seizures with blank stare
  - complex partial versus absence
- Patient has generalized convulsive activity
  - primary generalized tonic-clonic versus partial onset with secondary generalization
- Patient has tonic-clonic seizures with myoclonic jerks
  - consider juvenile myoclonic epilepsy

EEG in New-Onset Seizures

- May be normal in up to 50% of patients
- Simple partial seizures may not induce a change in scalp-recorded EEG activity
- Activation procedures used include
  - Hyperventilation
  - Intermittent photic stimulation
  - Sleep/sleep deprivation

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Sources:
Simple Partial Seizures

- **Locus**
  - One site or lobe
- **Manifestations**
  - Duration: ~30 seconds
  - involuntary muscle jerks, sensory (tastes or smells), psychic or emotional (fear)
  - olfactory sensation, metallic taste, light-headedness, bright light, rising sensation in stomach
- **Consciousness**
  - Patient retains consciousness


Complex Partial Seizures

- **Locus**
  - One or multiple sites or lobes, commonly bilateral mesial temporal lobes
- **Manifestations**
  - Duration: 1-3 minutes
  - Automatisms (picking at clothes, smacking lips, wandering, repeating words)
  - May begin as a smell (olfactory aura), metallic taste, light-headedness, bright light, rising sensation in stomach
  - May begin as simple partial seizures
- **Consciousness**
  - Patient has alteration of awareness


Complex Partial Seizures With Secondary Generalization

- **Locus**
  - Locally initiated, then spreads to both hemispheres
- **Manifestations**
  - Duration: ~2 minutes
  - Muscles rigid (tonic) – person falls down, rhythmic muscle contractions (clonic), shallow breathing, incontinence, postictal drowsiness
  - Partial seizure may be the beginning of a secondarily generalized seizure
- **Consciousness**
  - Patient loses consciousness

Primary Generalized Tonic-Clonic Seizures

- **Locus**
  - Both hemispheres affected from onset
- **Manifestations**
  - Duration: ~2 minutes
  - Muscles rigid (tonic) – person falls down, rhythmic muscle contractions (clonic), shallow breathing, incontinence, postictal drowsiness
  - Usually no aura or warning
- **Consciousness**
  - Patient loses consciousness

Absence Seizures

- Occur primarily in children
- **Locus**
  - Both hemispheres
- **Manifestations**
  - Duration: 2-15 seconds
  - Staring or blinking, upward rotation of eyes, no motor activity
  - Atypical absence seizures may involve automatisms and muscle twitching
  - Abrupt onset; usually no aura or warning
- **Consciousness**
  - Patient loses consciousness briefly but does not fall

Myoclonic Seizures

- **Locus**
  - Usually both hemispheres
- **Manifestations**
  - Rapid jerks of one or both arms or legs
  - May precede tonic-clonic seizures
- **Consciousness**
  - Patient may or may not lose consciousness


Atonic Seizures (Drop Attacks)

- **Locus**
  - Both hemispheres
- **Manifestations**
  - Duration: 1-60 seconds
  - Sudden loss of muscle control – patient may fall to floor, head drops down, jaw slackens
  - Frequent injuries occur
  - Usually no aura or warning
- **Consciousness**
  - Patient may lose consciousness


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Lennox Gastaut Syndrome

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Epilepsy and Quality of Life Issues

- Patients who are seizure-free report levels of QOL similar to those of the general population^a^
- QOL in people with epilepsy is significantly impaired compared with the general population^b,c^
  - High levels of anxiety and depression
  - Poor self-esteem
  - Problems with social interaction
- Number of adverse effects is a significant predictor of QOL^c^
- Driving is a major issue that must be addressed


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Epilepsy-Related Comorbid Conditions

- Cognitive impairment
- Depression
- Injury
- Endocrine dysfunction
- Migraine
- Sleep disorders


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Approaches to Epilepsy Management

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Goals of Pharmacotherapy

- Complete control of seizures^a-c^
- No adverse events^a-c^
- No drug-drug interactions
- Improved quality of life^c^
- Optimize growth and development in pediatric patients^a^

Initiating Therapy

- Monotherapy is preferable whenever possible
- Start at low dose of chosen antiepileptic drug (AED) and titrate to therapeutically effective dose
  - May be difficult to assess in patients with infrequent seizures
- If seizures persist, consider an alternative drug as monotherapy
- If a second drug must be added, dose of the first drug may need to be adjusted due to interactions
- If patient becomes seizure-free, dose of the initial drug may be reduced


AEDs Through the Years

1900 1920 1940 1960 1980 2000

phenobarb phenytoin ethosuximide carbamazepine valproate febraban felbamate lamotrigine gabapentin oxcarbazepine zonisamide levetiracetam


Selecting an AED

- Choose the AED most suited to the individual patient
  - seizure/epilepsy type
  - ease of use
  - cost
  - side effects
  - patient profile (eg, sex, age)
- Balance efficacy, tolerability, and safety
- Epilepsy may be a life-long diagnosis


Selecting an AED: Efficacy Issues

- Old drugs
  - VA trials – blinded comparator monotherapy
  - no placebo
  - CBZ, PHT, PB, primidone, VPA
- New drugs
  - placebo-controlled FDA registration trials
  - few direct comparative trials
  - most drugs produce 30%-40% reductions of seizures in refractory patients

Selecting an AED

- Choose the AED most suited to the individual patient
  - seizure/epilepsy type
  - ease of use
  - cost
  - side effects
  - patient profile (eg, sex, age)
- Balance efficacy, tolerability, and safety
- Epilepsy may be a life-long diagnosis

Seizure type and choice of AED

- For localization related epilepsy (simple partial, complex partial, or secondarily generalized seizures)
  - Carbamazepine, phenytoin, valproate, phenobarbital, primidone
  - Lamotrigine, topiramate, zonisamide, gabapentin, oxcarbazepine, levetiracetam, tiagabine, felbamate
- For primary generalized seizures
  - Valproate, lamotrigine, topiramate
- Zonisamide, levetiracetam
- For absence seizures
  - Ethosuximide or valproate

Adapted with permission from Collaborative Group for Epidemiology of Epilepsy. Epilepsia. 1986; 27(4):323-330.
**Selecting an AED: Tolerability Issues**

**Side Effects**
- Dose-related
- Idiosyncratic
  - eg, rash, hepatic, anemia
- CNS toxicity
  - eg, drowsiness, dizziness, ataxia, tremor
- Some may only be apparent after long-term use
  - eg, neuropathies, cosmetic effects, bone effects
- Teratogenic

**Newly Diagnosed Epilepsy:**
**Seizure Freedom With Monotherapy**

<table>
<thead>
<tr>
<th>Therapeutic Approach</th>
<th>% Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>First-drug monotherapy</td>
<td>47%</td>
</tr>
<tr>
<td>Second-drug monotherapy</td>
<td>13%</td>
</tr>
<tr>
<td>Third-drug monotherapy</td>
<td>1%</td>
</tr>
<tr>
<td>Duotherapy</td>
<td>3%</td>
</tr>
<tr>
<td><strong>Total seizure-free</strong></td>
<td><strong>64%</strong></td>
</tr>
</tbody>
</table>


**Traditional Antiepileptic Drugs:**
**Efficacy and Tolerability Issues**

**Traditional AEDs for Partial and Generalized Tonic-Clonic Seizures**

<table>
<thead>
<tr>
<th>Agent</th>
<th>Year Introduced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenobarbital</td>
<td>1912</td>
</tr>
<tr>
<td>Phenytoin</td>
<td>1938</td>
</tr>
<tr>
<td>Primidone</td>
<td>1952</td>
</tr>
<tr>
<td>Carbamazepine</td>
<td>1972</td>
</tr>
<tr>
<td>Valproate</td>
<td>1983 (in US)</td>
</tr>
</tbody>
</table>

**Traditional AEDs: Seizure Free Percentages in Partial and Generalized Tonic-Clonic Seizures**

<table>
<thead>
<tr>
<th>Seizure Type</th>
<th>Carbamazepine</th>
<th>Phenytoin</th>
<th>Valproate</th>
<th>Phenobarbital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reynolds 1976</td>
<td>-</td>
<td>74</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ramsay 1983</td>
<td>63</td>
<td>66</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Heller 1995</td>
<td>48</td>
<td>40</td>
<td>42</td>
<td>39</td>
</tr>
</tbody>
</table>


**Traditional AEDs: Seizure-Free Percentages in Generalized Tonic-Clonic Seizures**

<table>
<thead>
<tr>
<th>Seizure Type</th>
<th>Carbamazepine</th>
<th>Phenytoin</th>
<th>Valproate</th>
<th>Phenobarbital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Callaghan 1985 (1st GTC)</td>
<td>39</td>
<td>73</td>
<td>59</td>
<td>-</td>
</tr>
<tr>
<td>Turnbull 1985</td>
<td>-</td>
<td>56</td>
<td>73</td>
<td>-</td>
</tr>
<tr>
<td>Mattson 1985 (2nd GTC)</td>
<td>48</td>
<td>43</td>
<td>-</td>
<td>43</td>
</tr>
<tr>
<td>Mattson 1992 (2nd GTC)</td>
<td>59</td>
<td>-</td>
<td>46</td>
<td>-</td>
</tr>
</tbody>
</table>

### Seizure-Free Percentages in Partial Seizures

<table>
<thead>
<tr>
<th>Drug</th>
<th>Loiseau 1984</th>
<th>Mattson 1985</th>
<th>Turnbull 1985</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbamazepine</td>
<td>42</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Phenytoin</td>
<td>-</td>
<td>29</td>
<td>-</td>
</tr>
<tr>
<td>Valproate</td>
<td>58</td>
<td>27</td>
<td>18</td>
</tr>
<tr>
<td>Phenobarbital</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Primidone</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>


### Traditional AEDs: Aspects and Side Effects

<table>
<thead>
<tr>
<th>AED</th>
<th>Discontinuation rate</th>
<th>Sedation</th>
<th>Ataxia</th>
<th>Dizziness</th>
<th>GI effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbamazepine</td>
<td>12%</td>
<td>Sedation, dizziness</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Phenytoin</td>
<td>16%</td>
<td>Sedation, dizziness</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Valproate</td>
<td>19%</td>
<td>Sedation</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Phenobarbital</td>
<td>-</td>
<td>GI effect</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Initial side effects:
- Valproate, dizziness
- Phenytoin, dizziness

Dose-limiting side effects:
- Valproate, Ataxia
- Phenytoin, Sedation, depression

Dose-limiting side effects:
- Carbamazepine, Tremor, lethargy, weight gain


### Traditional AEDs: Cognitive Effects

- All traditional AEDs can produce cognitive side effects, especially at higher doses
- Effects at usual doses are most often mild or absent
- Phenobarbital has a high incidence of cognitive and behavioral adverse effects, especially in children – 60% vs 4% to 9% for valproate, carbamazepine, and phenytoin
- Phenytoin and carbamazepine are comparable


### Clinical Application of Traditional AEDs: Summary

- **Carbamazepine**
  - Best documented efficacy against complex partial seizures
  - Traditional AED of choice for partial seizures
- **Phenytoin**
  - Second-choice traditional AED for partial seizures but difficult to use
- **Valproate**
  - Traditional AED of choice for primary generalized seizures
  - Ethosuximide may be used for absence seizures alone
- **Barbituates**
  - Avoid, if possible

### Perspectives on the Newer Antiepileptic Drugs

- Only ~30% to 60% of patients achieve seizure freedom
  - 50% of patients achieve seizure freedom with partial seizures
- Inducers or inhibitors of cytochrome P450
  - Potential for drug failure or interactions
- Adverse reaction rate increases with polypharmacy
- Significant cognitive side effects may be seen
- Mechanism of action addresses GABA and voltage-gated Na channel
**Pattern of AED Use**

- **Failure of initial monotherapy**
- **Adjunctive therapy as bridge to alternative monotherapy**
- **Alternative monotherapy**

**The Newer Antiepileptic Drugs: 2003**

<table>
<thead>
<tr>
<th>Agent</th>
<th>Year Introduced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Felbamate (Felbatol)</td>
<td>1993</td>
</tr>
<tr>
<td>Lamotrigine (Lamictal)</td>
<td>1994</td>
</tr>
<tr>
<td>Topiramate (Topamax)</td>
<td>1996</td>
</tr>
<tr>
<td>Tiagabine (Gabitril)</td>
<td>1997</td>
</tr>
<tr>
<td>Gabapentin (Neurontin)</td>
<td>1998</td>
</tr>
<tr>
<td>Levetiracetam (Keppra)</td>
<td>1999</td>
</tr>
<tr>
<td>Oxcarbazepine (Trileptal)</td>
<td>1999</td>
</tr>
<tr>
<td>Zonisamide (Zonegran)</td>
<td>2000</td>
</tr>
</tbody>
</table>

**Potential Advantages of Newer AEDs**

- Most are broad spectrum
  - work in multiple seizure types
- Improved safety
- Better tolerability
- Effective
- Fewer interactions
- Better for female patients

**The Newer AEDs: Spectrum of Activity**

<table>
<thead>
<tr>
<th>AED</th>
<th>Partial</th>
<th>Lennox-Gastaut</th>
<th>Juvenile Myoclonic Epilepsy</th>
<th>Absence</th>
<th>Generalized Tonic Clonic Seizures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zonisamide</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Gabapentin</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Lamotrigine</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Tiagabine</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Oxcarbazepine</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Felbamate</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

*+=randomized controlled trials; ?+= case reports or open-label trials only; ?=no data;
= any negative data or evidence of worsening

**Tolerability of the Newer AEDs: Most Common Adverse Events in Adults**

<table>
<thead>
<tr>
<th>AED</th>
<th>Adverse Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>Felbamate</td>
<td>Anorexia, Vomiting, insomnia, nausea, and headache</td>
</tr>
<tr>
<td>Gabapentin</td>
<td>Somnolence, dizziness, ataxia, fatigue, and nystagmus</td>
</tr>
<tr>
<td>Lamotrigine</td>
<td>Dizziness, ataxia, somnolence, headache, diplopia, blurred vision, vomiting, and rash (some severe)</td>
</tr>
<tr>
<td>Topiramate</td>
<td>Somnolence, dizziness, ataxia, speech problems, psychomotor slowing, abnormal vision, difficulty with memory, paresthesias, diplopia, and weight loss</td>
</tr>
<tr>
<td>Zonisamide</td>
<td>Somnolence, anorexia, dizziness, headache, nausea, and agitation/irritability, weight loss</td>
</tr>
</tbody>
</table>


**Tolerability of the Newer AEDs: Most Common Adverse Events in Adults (con’t)**

<table>
<thead>
<tr>
<th>AED</th>
<th>Adverse Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tiagabine</td>
<td>Dizziness/light-headedness, asthenia/lack of energy, somnolence, nausea, nervousness/irritability, tremor, abdominal pain, and thinking abnormal/difficulty with concentration or attention</td>
</tr>
<tr>
<td>Levetiracetam</td>
<td>Somnolence, asthenia, infection, and dizziness</td>
</tr>
<tr>
<td>Oxcarbazepine</td>
<td>Dizziness, somnolence, diplopia, fatigue, nausea, vomiting, ataxia, abnormal vision, abdominal pain, tremor, dyspepsia, and abnormal gait</td>
</tr>
</tbody>
</table>

The Newer AEDs: Summary

- The 8 newer AEDs may represent advances over older AEDs with respect to pharmacokinetics and side effects
- Overall, the newer AEDs:
  - have broader spectrum of activity
  - are safer (with the exception of felbamate)
  - are well tolerated (with the exception of felbamate)
  - are as efficacious as the traditional AEDs
  - have fewer interactions
  - are better for women

Summary

- Evaluation of a seizures involves assessing provoking factors, and risk of recurrence
- EEG is helpful for prognosis and seizure classification
- If treatment is warranted, selection of AED depends on seizure type, patient profile, and drug characteristics, especially tolerability
- Seizure freedom, if possible, is the goal of treatment
- With traditional AEDs 30-60% of patients achieve seizure freedom.

Summary (continued)

- Traditional AEDs interact with cytochrome P450, with potential for drug interactions; all have cognitive side effects
- Newer AEDs are generally better tolerated, have fewer idiosyncratic reactions, fewer drug-drug interactions, a broader spectrum of activity, and may be safer for women, children, and the elderly

Future Directions

- Imaging—better visualization of seizure focus
- Increased understanding of cellular mechanisms of AEDs will lead to more intelligent use of polypharmacy
- Understanding of the genetic basis of epilepsy syndromes will allow the opportunity for early intervention
- Surgery will become an increasingly utilized option for selected patients