The Diagnostic Detective: Epilepsy

Some Facts About Epilepsy and Its Causes

- Seizures are the most common neurologic disorders affecting children
- 5% of children have a seizure during childhood
- There are 380,000 children with uncontrolled seizures in the USA
- Of all new cases of epilepsy, 90% occur before the age of 20
- One in one hundred Americans have epilepsy

Post - traumatic Epilepsy

- Higher incidence with penetrating trauma
- Early seizures (first week after trauma)
- Late seizures in 25-45% of patients (50% by one year; 80% by two years)
- Many develop complex partial seizures as a result of head trauma
- Dilantin effective in treating early seizures
- Prophylaxis with Dilantin does not decrease the incidence of late onset epilepsy

Infection of the Brain

- High risk for epilepsy even several years after the original infection (brain abcess, subdural empyema)

Abnormality of Blood Vessels in the Brain Leading to Strokes/Bleeding in the Brain

- High risk for seizures
- Untreated surgically: 1% per year risk for epilepsy
- If seizures were to develop after surgery, usually occurs in the first five years

Genetic Disorders with Increased Risk for Seizures/Epilepsy

- Chromosomal Abnormality: Deletion, Trisomies
- Single Gene Disorders
  - Tuberous Sclerosis
  - Neurofibromatosis
- Multifactorial Spina Bifida

Epilepsy Syndrome

Grouping of similar epileptic patterns based on seizure types, EEG, age of onset, prognosis, and other clinical signs.

Landau Kleffner Syndrome (acquired epileptic aphasia of childhood)

- Seizures may be minimal or frequent
- Loss of language, particularly receptive, in previously normal child
- Etiology unknown, occasionally due to encephalitis
- EEG: focal abnormalities in dominant temporal lobe, continuous spike-wave during sleep
- Associated disability: language deficits may not improve despite better control of any seizure
- Treatment: may not be responsive to medication

West Syndrome (Infantile Spasms, MIS, or Massive Infantile Spasms)

- Age of onset younger than one year
- Myoclonic jerks (flexion or extension of the trunk, arms and legs) occur in clusters
- Uncontrolled seizures which eventually cease with or without treatment
- Commonly becomes Lennox Gastaut or multi-focal seizures
- EEG, hypsarrhythmia, burst suppression
- Etiology: some unknown; known causes include tuberous sclerosis, CNS abnormality, infection
- Associated disabilities: loss of developmental landmarks common at onset, with significant mental retardation generally universal
- Treatment: medication, in particular Vigabatrin; ketogenic diet; surgery

Lennox Gastaut Syndrome

- Age of onset one to three years
- Multiple seizure type (atonic, clonic, atypical absence)
- Often follows infantile spasms
- EEG: 1-2.5 Hz spike and wave (slow spike and wave)
- Etiology: 1/3 unknown; among known causes tuberous sclerosis, brain infection/trauma/tumors
- Associated disability: mental retardation common at onset and nearly universal by five years after onset
- Treatment: monotherapy rarely works, polytherapy often needed, with Felbatol emerging as the drug of choice; surgery, if appropriate primarily to stop drop attacks

Benign Rolandic Epilepsy

- Occurs between three and thirteen years of age (peak 9-10 years of age)
- Remission by 15-16 years of age
- Male predominance
- Seizure type: hemifacial to generalized
- EEG: Central temporal spikes in drowsiness

Events Which May Lower Seizure Threshold And Trigger Seizures

- Lack of sleep
- Drug toxicity/drug abuse
- Poor nutrition
- Intercurrent illnesses (fever, infections)
- Menstruation
- Emotional stress
- Extreme fatigue
- Hyperventilation
- Alcohol use/abuse
- Missed medication

Diagnosis of Epilepsy

Neurological Evaluations

- History
- Physical examination may include the following
  - EEG
  - Imaging studies (CT Scan, MRI)
  - Blood tests
- Referral to other specialists, such as Neurosurgery, Genetics

Electroencephalogram (EEG)

- Assists in classifying the epilepsy
- Suggests an etiology
- Guides clinical management (e.g., choice of drugs, continuation of medication)
- Provides evidence of localization when epilepsy surgery is contemplated
- Generally of no benefit in children with febrile convulsions
- Normal EEG does not rule out epilepsy
- Abnormal EEG (epileptiform abnormalities) does not necessarily indicate the presence of epilepsy, and can be found in 3% of normal children & up to 1/4 of healthy siblings of children with benign partial epilepsy

Management of Epilepsy

Seizure Medications

Phenobarbital (Luminal)

- For generalized tonic-clonic seizures; all forms of partial seizures
- Possible side effects: sedation, paradoxical excitement, rash, irritability and hyperactivity, especially in children
- Most common signs of toxicity: drowsiness, ataxia, crossed eyes, slurred speech

Phenytoin (Dilantin)

- For generalized tonic-clonic seizures: all forms of partial seizures
- Possible side effects: skin eruptions, coarsening of facial features, decreased blood folate levels, hepatitis, systemic lupus, fever, gum problems, hypocalcemia, osteomalacia, lymphadenopathy
- Most common signs of toxicity: crossed eyes, ataxia, slurred speech, drowsiness, diplopia, blurred vision

Primidone (Mysoline)

- For generalized tonic-clonic seizures; all forms of partial seizures
- Possible side effects: same as Phenobarbital
- Most common signs of toxicity: same as Phenobarbital

Ethosuximide (Zarontin)

- For absence seizures
- Possible side effects: nausea, skin rash, drowsiness, hiccups, blood dyscracias
- Most common signs of toxicity: nausea, vomiting, anorexia, lethargy, headache, hiccups

Carbamazepine (Tegretol)

- For all forms of partial seizures; generalized tonic-clonic seizures
- Common side effects: nausea, vomiting, anorexia, blood dyscracias
- Most common signs of toxicity: vertigo, drowsiness, crossed eyes, diplopia, unsteadiness

Valporic Acid (Depakene)

- For absence seizures; mixed seizures in which absence is present
- Common side effects: nausea, vomiting, drowsiness, weight gain, hypersalivation, diarrhea, transient alopecia, thrombocytopenia, liver toxicity
- Most common signs of toxicity: ataxia, sedation

Newer Anticonvulsant Medications

Gabapentin (Neurontin)

- FDA approved in 1993 for partial seizures with/without secondary generalization in patients older than 12 years
- Not yet approved for use with younger children

Felbamate (Felbatol)

- FDA approved in 1993
- Used for treatment of refractory seizures and Lennox Gastaut syndrome
- Side effects may include headache, dizziness, ataxia, nausea, vomiting, and aplastic anemia

Topiramate (Topamax)

- FDA approved in 1996 as add on therapy in adults with partial epilepsies
- appears effective in Lennox Gastaut syndrome, partial and generalized seizures in children
- Dosages must be titrated slowly
- Side effects may include sedation, confusion, cognitive dysfunction (reversible on lowering the dose)

Lamotrigine (Lamictal)

- FDA approved in 1994 for added therapy of partial seizures in patients older than 16 years
- Not yet approved for children younger than 16, except for those with Lennox Gastaut syndrome
- Effective for generalized seizures, Lennox Gastaut, juvenile myoclonic and infantile spasms
- Works for children with or without neurological impairment/encephalopathic epilepsy
- Side effects may include slight dizziness, ataxia, somnolence, rash

Vigabatrin (Sabril)

- FDA approval pending
- Good results for refractory partial seizures, cryptogenic partial seizures and Lennox Gastaut syndrome
- In children, particularly efficacious for infantile spasms

Fosphenytoin (Cerebryx)

- FDA approved for adults as parenteral form for status epilepticus. Not yet approved for children
- Composition change for dilantin so does not have the tissue toxicity as IV dilantin
- Can also be given intramuscularly

- Side effects comparable to IV Dilantin (dizziness, ataxia, headache)

When To Stop Seizure Medication?

Successful withdrawal

- Either gender
- Less than 30 years of age
- Primarily generalized epilepsy or partial seizure without secondarily generalized
- Rapid response of seizures to anticonvulsant
- Seizure free for 2-5 years on anticonvulsant
- Normal neurological examination
- Normal EEG prior to withdrawal
- Seizure control with a single drug

Surgery

- For intractable seizures, surgery will now be considered earlier as an option
- Cortical resection for epilepsy first demonstrated in the 1940's and 1950's
- In children the technique was emphasized in the 1960's and 1970's
- Types
    - Lobectomy (temporal/extra temporal)
    - Corpus callosotomy
    - Hemispherectomy
    - Subpial transsection
- Outcome 70-85% significant reduction/near free or free of seizures following temporal lobectomy or hemispherectomy
- Less successful following extra temporal lobectomy

Vagus Nerve Stimulation

- Electrical stimulation of the vagus nerve
- Implantable device in the chest wall
- Used for intractable seizures
- Reduces seizures by 20-40%
- Side effects: pain, discomfort in the throat, changes in voice tone, hoarseness, paralysis of the vocal cord, nausea, ringing in the ears, abdominal pain, infection

Ketogenic Diet

- First devised in the 1920's to treat children with intractable seizures
- Diet high in fat and low in carbohydrate and protein (ratio of 4:1)
- It is suspected that it works through the neurotransmitter GABA
- Works best in children aged 1-8 years, with idiopathic epilepsy rather than those with brain lesion
- Outcome for seizure control: 1/3 fully controlled, 1/3 partially controlled, and 1/3 with no improvement. Those with full seizure control remain free of seizure following discontinuation of diet
- Rigorous, challenging, and time-consuming for the family
- Changes in family routine necessary
- Side effects include constipation, thirst/hunger, irritability, inattentive, low blood sugar, and kidney stones. Long-term effects unknown: possibly obesity, heart disease
- Must be instituted as an inpatient
- Typical day on the diet: breakfast-scrambled eggs with butter, diluted cream and orange juice; lunch-lettuce leaf with mayonnaise, spaghetti squash with butter and parmesan cheese, orange diet soda mixed with whipped cream; dinner- asparagus with butter, chopped lettuce with mayonnaise, hot dog slices with catsup, vanilla cream popsicle