General Neurology and Epilepsy Refresher

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Content

- Epilepsy in children
  - Incidence and prevalence
- Common seizure classification and seizure semiology
- Prolonged, acute seizures in children and emergency treatment

Seizures vs Epilepsy

- What are seizures?
  - A sudden burst of excessive electrical activity in brain cells causing a chemical (neurotransmitter) imbalance
  - Causes momentary or lengthy disruption of normal communication systems between nerve cells (epileptic discharges)

Seizures vs Epilepsy

- What is epilepsy?
  - A chronic condition
  - Tendency to have recurrent, unprovoked seizures
  - Normally diagnosed after two or more seizures >24 hours apart

Incidence and Prevalence

- Incidence: rate of new cases of a disease
  - Generally reported as the number of new cases within a period of time (e.g., per month, per year)
- Prevalence: proportion of cases in the population at a given time rather than rate of occurrence of new cases

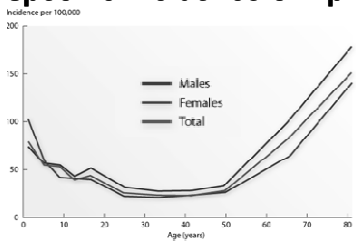
Incidence and Prevalence

- Incidence conveys information about the risk of contracting the disease, whereas prevalence indicates how widespread the disease is

Incidence and Prevalence of Epilepsy

- Average incidence of epilepsy each year in the US: 150,000 or 48 for every 100,000
- Over a lifetime, 1 in 26 people will develop epilepsy
- Number of people with epilepsy: approximately three million Americans of all ages (Double the number with autistic spectrum disorders, multiple sclerosis, and Parkinson's disease combined)

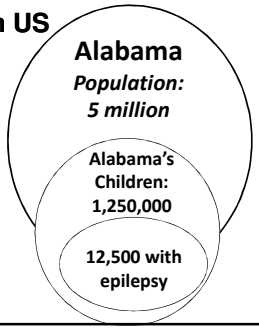
Age-specific Incidence of Epilepsy



- Incidence highest in
  1. <2 years old
  2. >65 years old
- This means that epilepsy starts more often in these age groups

Epilepsy Scope of Problem

- Epilepsy- recurrent seizures
- 2 million people in US
- 1% of all children



Children and Epilepsy

- Common childhood neurological condition[1]
- Treatment priority – to prevent/control seizures; this offers better global outcome for the child[1]
- Optimal therapy can lead to 70% seizure freedom1

1. Lagae. *Eur J Pediatr* 2011; 2. Beume *et al. Neuropaediatrics* 2010

Seizure Classification

Focal

Focal discharges

Some loss of awareness

Generalized

Discharges coming from both hemispheres

Complete loss of consciousness

Seizure Classification

Focal

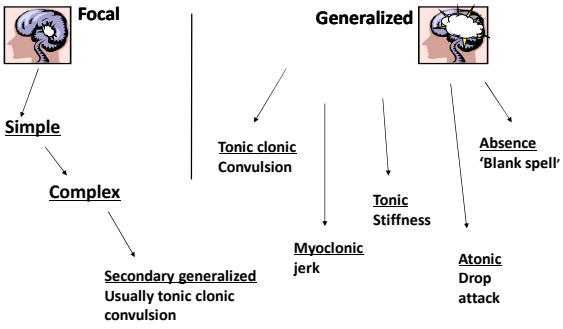
Generalized

Simple
'Aura'

Complex
Change in awareness and behaviour

Secondary generalized
Usually tonic clonic convulsion

SEIZURE CLASSIFICATION



A Seizure May Appear as:

- A sudden cry and fall and stiffening, followed by
- Convulsive movements of all limbs
- Shallow/interrupted breathing - cyanosis
- Loss of bowel / bladder control
- Generally lasts 1 - 3 minutes
- Followed by confusion, sleepiness

generalized tonic-clonic seizure

or a Seizure May Be…

- Rhythmic movements - isolated twitching of arms, face, legs
- Sensory symptoms - tingling, weakness, sounds, smells, tastes,
- Feeling of upset stomach, visual distortions
- Psychic symptoms - déjà vu, hallucinations, feelings of fear or anxiety
- May precede a generalized seizure

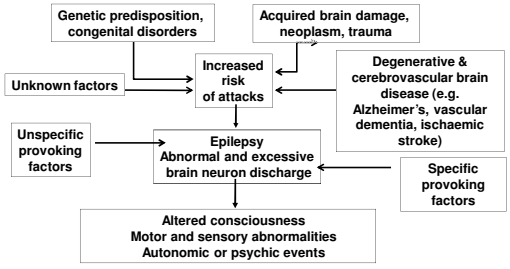
simple partial seizure/aura

Common Causes of Acute Seizures

- High fever, especially in infants
- Failure to take medication correctly
- Variation in medication effectiveness
- Sleep deprivation
- Stress / Illness
- Hypoglycemia / dehydration
- Alcohol/drug use or withdrawal
- Flashing lights or other triggers
- Head trauma

CAUSES of EPILEPSY AND CLINICAL MANIFESTATIONS

Most common serious brain disorder worldwide (5% of people can expect ≥1 seizure during lifetime)[1]



1. ILAE/IBE/WHO. Epilepsy in the WHO European region: Fostering Epilepsy Care in Europe. 2010

Quality of Life

- Related to:
  - Seizure freedom
  - Side effects of medication
  - Education
  - Socialization
  - Driving

Comorbidities in Epilepsy

- Cerebral palsy
- Cognitive impairments
- ADD / ADHD
- Developmental disabilities
- Autism
- Cognitive disturbance and learning disabilities occur in 38 – 49% of children with active epilepsy

Children & Prolonged Acute Convulsive Seizures

- One of the most common neurological emergencies affecting children worldwide
- Regarded as medical emergencies requiring immediate seizure control measures
- Untreated seizures can progress to status epilepticus (SE)

Prolonged Acute Seizures

- The evolving definition of status epilepticus (SE):
  - A seizure lasting >5 minutes,

    or
  - Two or more seizures without a return of consciousness between seizures

Prolonged Acute Seizures
Treatment

- Immediate treatment is recommended for:
  - Prolonged seizures ≥5 minutes,

    or
  - Repeated convulsive seizures (≥3 in an hour)
- Treatment delay lessens the chance of successful response to a single medication

Why is Emergency Treatment Important?

- A seizure lasting 5 minutes is unlikely to stop spontaneously and presents an increased risk for progression to SE
- Associated with more positive outcomes, generally

Reasons for Treatment Delay

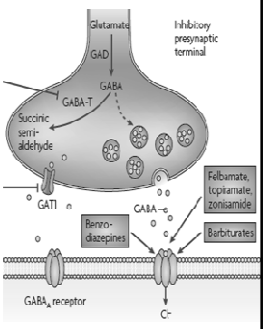
- Parent too frightened to clearly assess situation or recognise as seizure
- Delay in paramedic or ambulance staff accessing the child to administer medication
- Delay to hospital or clinician to correctly assess and authorise/administer emergency medication

What are the Consequences of Treatment Delay?

- **Increased risk of:**
  - **Morbidity: Falls, head injuries, fractures and burns**
  - **Mortality and / or progression to SE (medical emergencies requiring immediate seizure control measures)**

Emergency Medication
Benzodiazepines

- **Drugs of choice for acute seizures**
- **Fast penetration into brain and rapid onset of action**
- **bind to GABA-A receptor of the post-synaptic cell, preventing GABA re-uptake, allowing GABA to inhibit cell excitation**
- **Stops seizure (usually within 1–2 minutes)**





Seizure Rescue Medication Options



How Emergency Medication Works

- **Passes across the mucosal membranes and is absorbed into the blood stream**
- **Travels directly to the brain**
- **Works at nerve cell junctions**
  - **Reduces brain excitability**
  - **Suppresses seizure activity**

Rectal Diazepam Gel

Benefits	Drawbacks
Dose comes a in preloaded and premeasured syringe from the pharmacy (less room for user error and more convenient)	Modesty is compromised during administration (patient must be partially undressed)
Portable (does not need to be kept refrigerated)	Administration may be viewed as invasive
Useful when oral administration of rescue medication is contraindicated (excessive secretions, vomiting, etc.)	Caregivers may not be comfortable administering rectal medication

Midazolam

Benefits	Drawbacks
- 5mg/mL intravenous form can be given intranasally via an atomizer - Administration is relatively easy and modesty is preserved 	- Intranasal administration is not yet approved by the US Food and Drug Administration - Atomizer is not available at all pharmacies
- A 2mg/mL oral syrup can be given buccally 	- Contraindicated if patient has excessive secretions or is vomiting

Clonazepam Orally Disintegrating Tablet

Benefits	Drawbacks
Comes as a prepackaged, ready-to-administer, orally disintegrating tablet 	Available dosages may not be appropriate for smaller children
	Patient may need to be positioned in a specific way to avoid injury during administration if his or her teeth are clenched

Seizure Rescue Medications Adverse Effects

- Depression of respiratory effort
- Restlessness
- Agitation
- Disorientation
- Severe drowsiness (possibly for several hours)

Summary *(Acute Treatment)*

- Prolonged, acute, convulsive seizures common in children with epilepsy
  - seizures >5 minutes unlikely to cease alone
- Rescue medication prevents progression to status epilepticus, unnecessary transport to emergency rooms, and the cost of escalated care
- Prompt treatment associated with 80% response rate; response declines quickly with increasing treatment delay