The fitting child

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What I am *not*

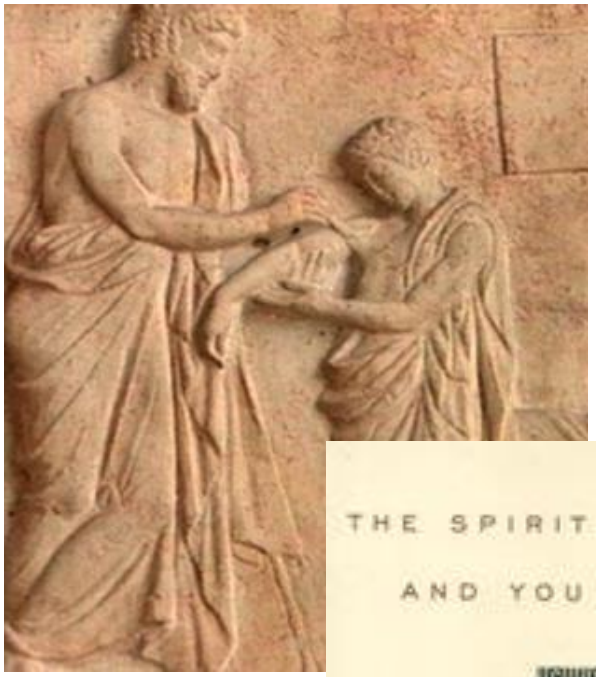
Detail from *The Neurolo*gist,
Jose Perez

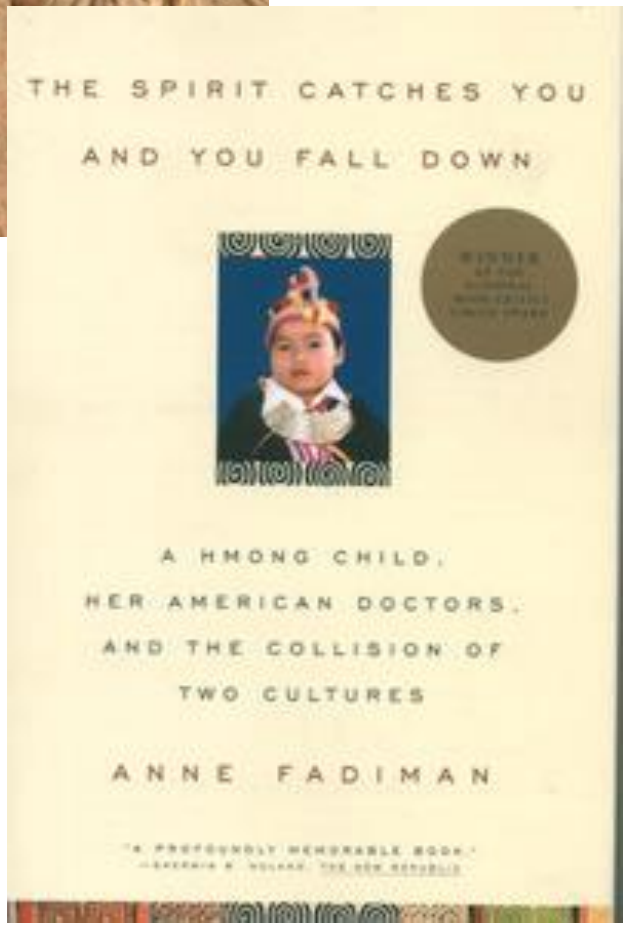
The “sacred disease”

Epilepsy comes from the ancient Greek verb *epilambanein*, “to be seized, overwhelmed by surprise”

UK laws which permitted the annulment of a marriage on the grounds of epilepsy were not amended until 1971 (WHO)

Hippocrates: “The alleged divine character is only a shelter for ignorance and fraudulent practices”





Definitions

- Seizure: “the clinical expression of abnormal, excessive, synchronous discharges of neurons residing primarily in the cerebral cortex”
- Convulsion: “a seizure with prominent alterations of motor activity”
- Epilepsy, or seizure disorder: “a condition of susceptibility to recurrent seizures”

Textbook of Pediatric Emergency Medicine, 7e

Table 2. Operational (practical) clinical definition of epilepsy

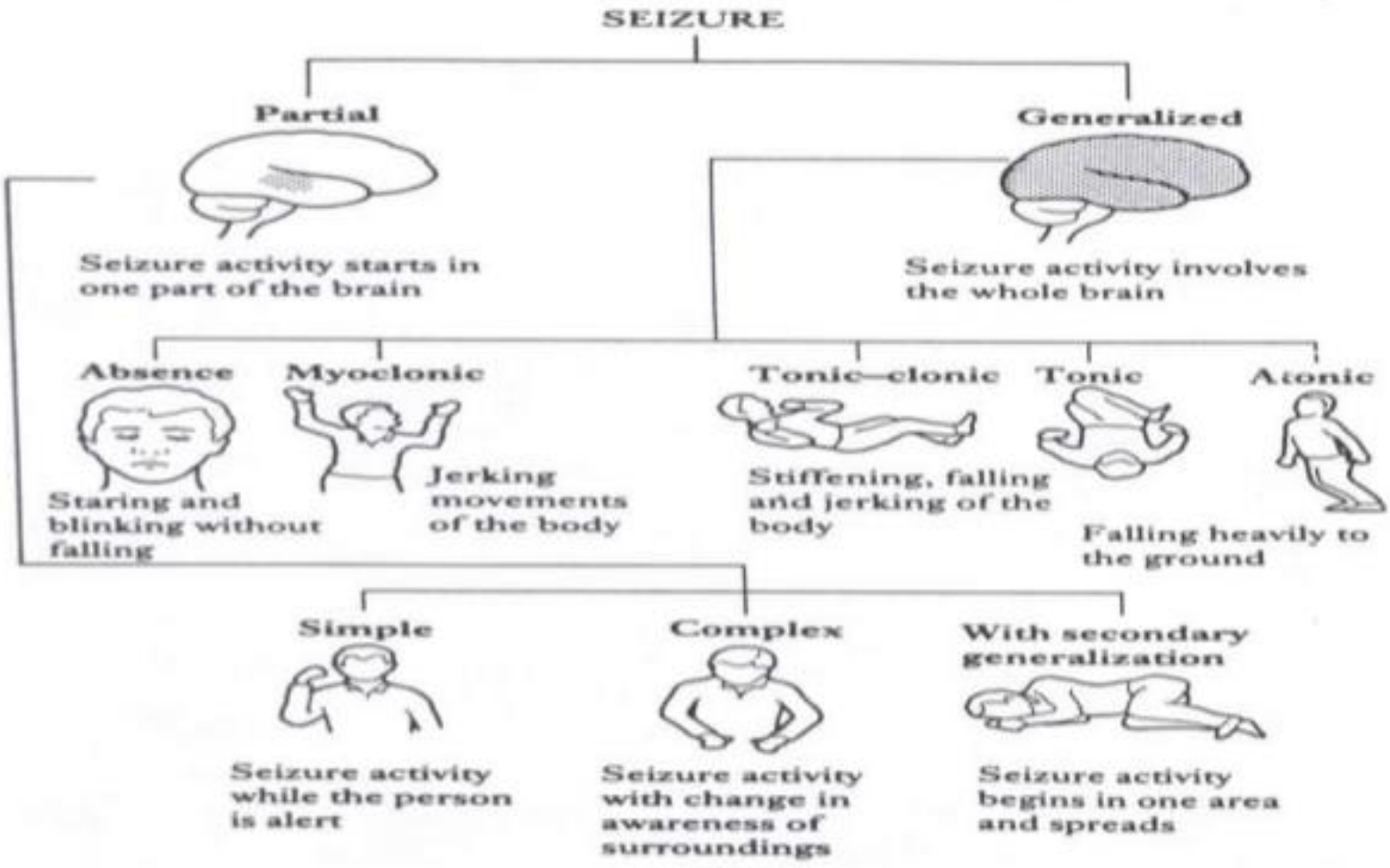
Epilepsy is a disease of the brain defined by any of the following conditions

1. At least two unprovoked (or reflex) seizures occurring >24 h apart
2. One unprovoked (or reflex) seizure and a probability of further seizures similar to the general recurrence risk (at least 60%) after two unprovoked seizures, occurring over the next 10 years
3. Diagnosis of an epilepsy syndrome

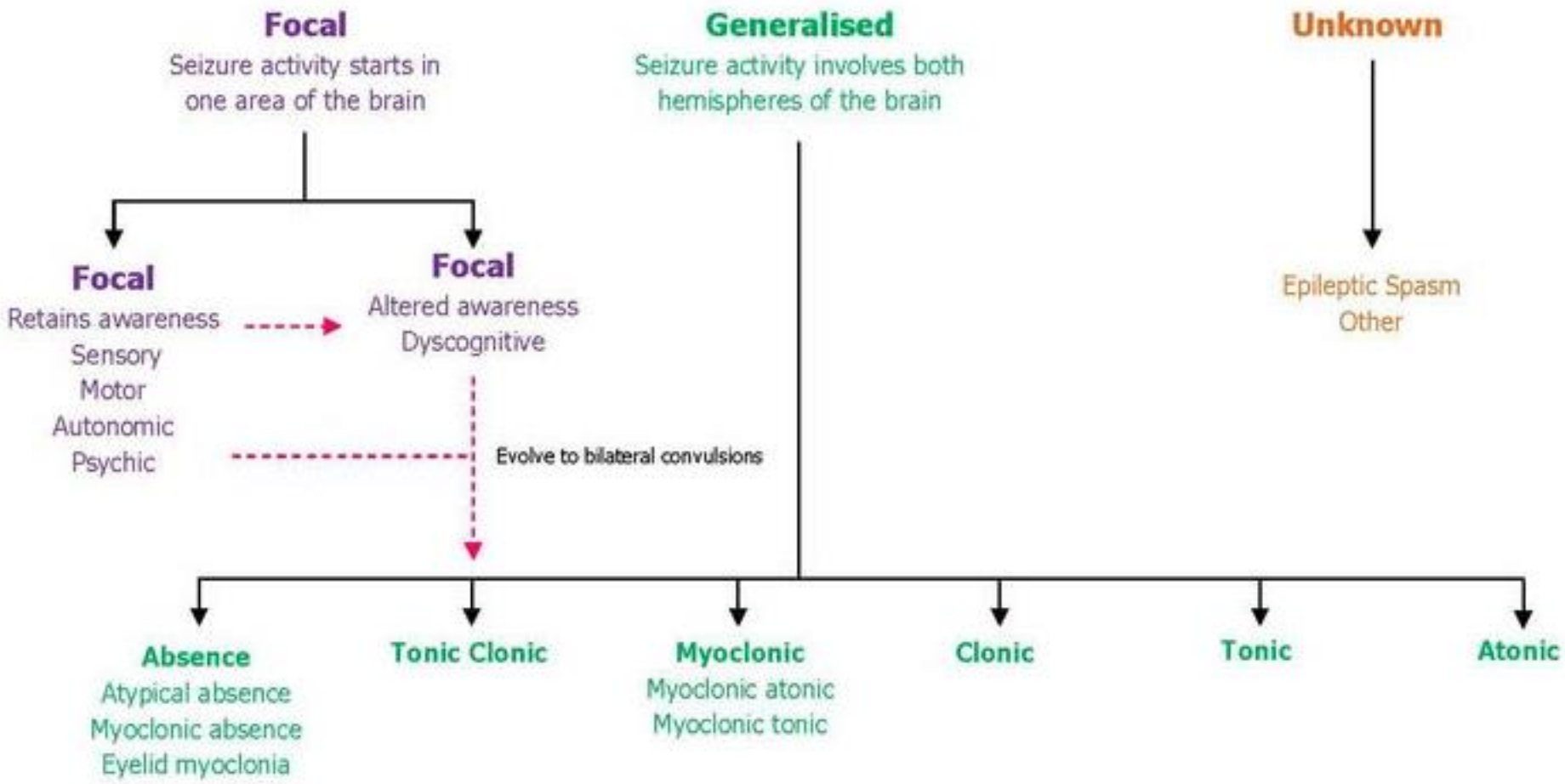
Epilepsy is considered to be *resolved* for individuals who had an age-dependent epilepsy syndrome but are now past the applicable age or those who have remained seizure-free for the last 10 years, with no seizure medicines for the last 5 years.

International League Against Epilepsy, 2014

Classification of Epileptic Seizures

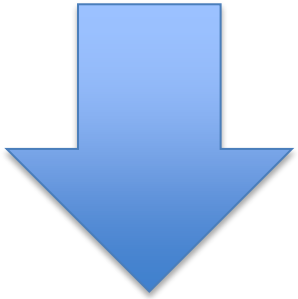


Seizure Classification



Seizures

- increased oxygen and glucose consumption (*a child's basal metabolic rate is double that of an adult's*)
- increased carbon dioxide and lactic acid production



- Unchecked, can lead to hypoxia and respiratory acidosis, while prolonged skeletal muscle activity can cause metabolic acidosis, rhabdomyolysis, hyperkalaemia
- The longer untreated, the more difficult to stop (neuronal damage after approx 30 mins)

Emergency management

Airway – give oxygen, if no trauma, on side to stop pooling of secretions

Breathing - ?aspiration

Circulation – attempt IV access

DEFG - Check blood sugar, check temp and for rashes

Correct hypoglycaemia – can try hypostop to buccal mucosa if in an area where no/difficult IV access

If outside hospital, get help, call an ambulance

If fitting >5mins, or length of seizure unknown, and 1 or no previous benzodiazepines, IV Lorazepam 0.1mg/kg (max 4mg)

Buccal midazolam doses (see training video in resources)

- Neonate 300 microgram as a single dose Child 1-6 months 300 micrograms/kg (max 2.5mg), repeated once if necessary
- Child 6 months–1 year 2.5mg, repeated once if necessary
- Child 1-5 years 5mg, repeated once if necessary
- Child 5-10 years 7.5mg, repeated once if necessary
- Child 10-18 years 10mg, repeated once if necessary

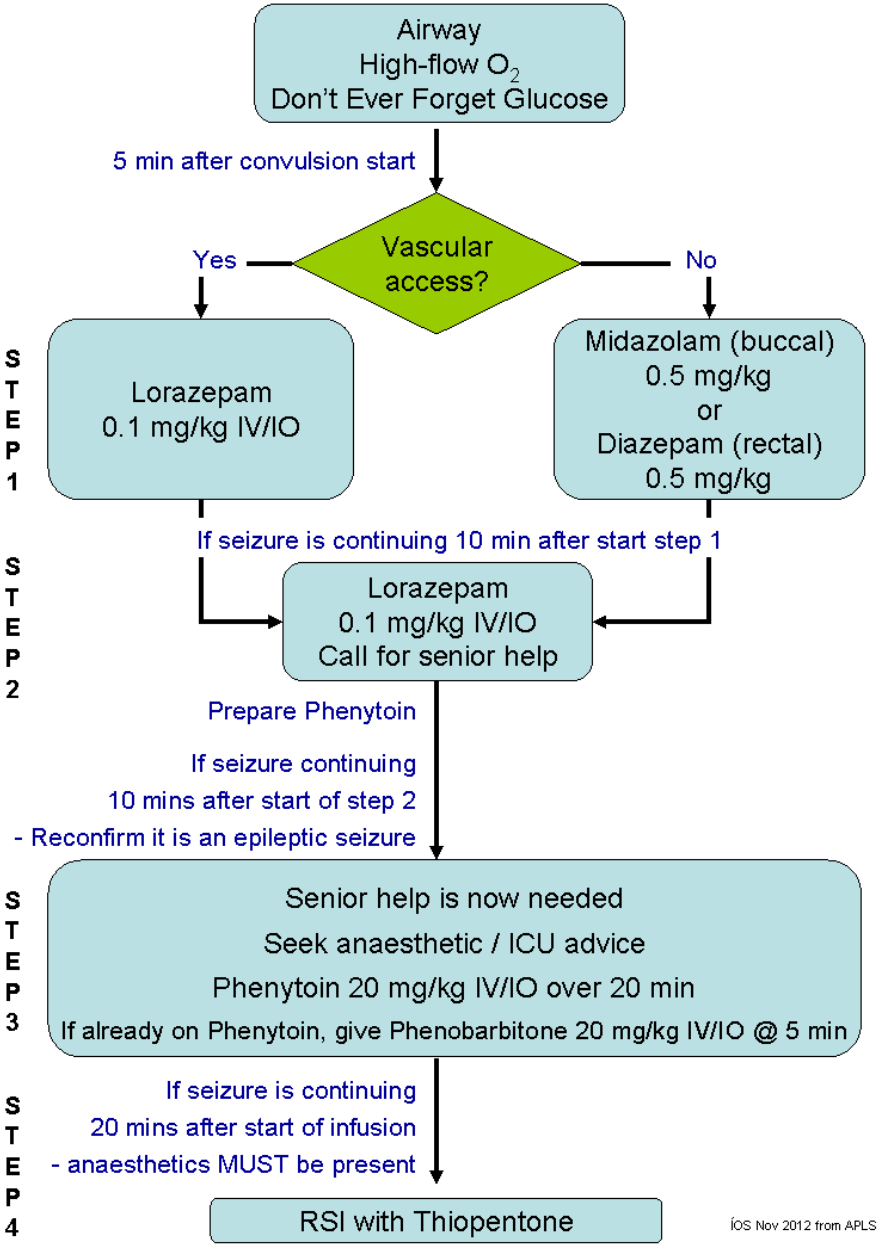
Diazepam rectal doses (squeeze the cheeks!)

- Neonate 1.25-2.5mg repeated after 5minutes if necessary
- Child 1 month–2 years 5mg repeated after 5 minutes if necessary
- Child 2–12 years 5-10mg repeated after 5 minutes if necessary
- Child 12–18 years 10mg repeated after 5 minutes if necessary

Wet flag

- Weight
- Energy
- Tube
- Fluids
- Lorazepam
- Adrenaline
- Glucose

APLS – Status Epilepticus



ÍOS Nov 2012 from APLS

EcLiPSE

Phenytoin an old drug (invented 1908, used for seizures from 1936)

Infusions have risk of hypotension, arrhythmias, extravasation injies, slow to give

Keppra can be given more quickly, fewer SEs

Trial is using delayed consent to enroll patients

ETIOLOGY OF SEIZURES[a]

- Infectious
  - Brain abscess
  - Encephalitis
  - **Febrile (nonspecific)**
  - Meningitis
  - Parasites (central nervous system)
  - Syphilis
- **Idiopathic**
- **Subtherapeutic anticonvulsant level**
- Withdrawal
  - Alcohol
  - Hypnotics
- Toxicologic
  - Anticonvulsant
  - Camphor
  - Carbon monoxide
  - Cocaine
  - Heavy metals (lead)
  - Hypoglycemic agents
  - Isoniazid
  - Lithium
  - Methylxanthines
  - Pesticides (organophosphates)
  - Phencyclidine
  - Sympathomimetics
  - Tricyclic antidepressants
  - Topical anesthetics
- Degenerative cerebral disease
- Hypoxic ischemic injury
- Metabolic
  - Hepatic failure
  - Hypercarbia
  - Hyperosmolarity
  - Hypocalcemia
  - Hypoglycemia
  - Hypomagnesemia
  - Hyponatremia
  - Hypoxia
  - Inborn errors of metabolism
    - Pyridoxine deficiency
  - Uremia
  - Vascular
  - Cerebrovascular accident
  - Hypertensive encephalopathy
  - Oncologic
  - Primary brain tumor
  - Metastatic disease
- Endocrine
  - Addison disease
  - Hyper/hypothyroidism
- Obstetric
  - Eclampsia
- Traumatic
  - Cerebral contusion
  - Diffuse axonal injury
  - Intracranial hemorrhage
- Congenital anomalies

Points to cover in history

Seizure

- Who witnessed seizure?
- Context in which seizure happened
- Apparent triggers?
- Pre-seizure warning symptoms?
- Onset of seizure (witnessed? focal component?)
- Nature of seizure (motor component? any laterality? vocalisations? degree of responsiveness? eye/head deviation? duration?)
- Post-seizure details (drowsiness/confusion? incontinence? injury? behavioural change? other features, including headache/vomiting/weakness?)

Other Features

- Recent fever?
- Recent intercurrent illness or symptoms suggestive of encephalopathy?
- Recent head injury?
- Family history (epilepsy, arrhythmias, sudden death, etc.)
- Development
- Learning, behaviour, concentration problems?

Examination

All children require a thorough examination, including:

- Full vital signs and PEWS
- Full neurological assessment and conscious level
- Cardiovascular examination and BP
- Chvostek's sign (ipsilateral facial contraction on percussion of the facial nerve), which suggests hypocalcaemia
- Signs of dysmorphism or neurocutaneous syndromes
- Signs of head trauma or NAI

Differential diagnosis (not exhaustive)

- Reflex anoxic seizure
- Cyanotic breath-holding attacks
- Sleep myoclonus
- Gastro-oesophageal reflux
- Vasovagal syncope
- Pseudoseizures

Assessment - examination

Ask the parents if they filmed the episode with a smartphone (and if not, gently suggest they do so if any subsequent seizure)

Post ictal child, initial examination will be limited – they must wait in dept (or be referred on to paeds) to ensure they wake up and can be fully assessed

Full cardioresp, abdominal exam (and ENT, exposure for rashes if fever); exposure to look for neurocutaneous syndromes

Full neurological exam (upper and lower limbs, CN, PERL, fundoscopy to ensure no focal lesion -> SOL)

PMC full text: Arch Dis Child. 2007 Jan; 92(1): 39–42.
Published online 2006 Jul 4. doi: 10.1136/adc.2004.069518

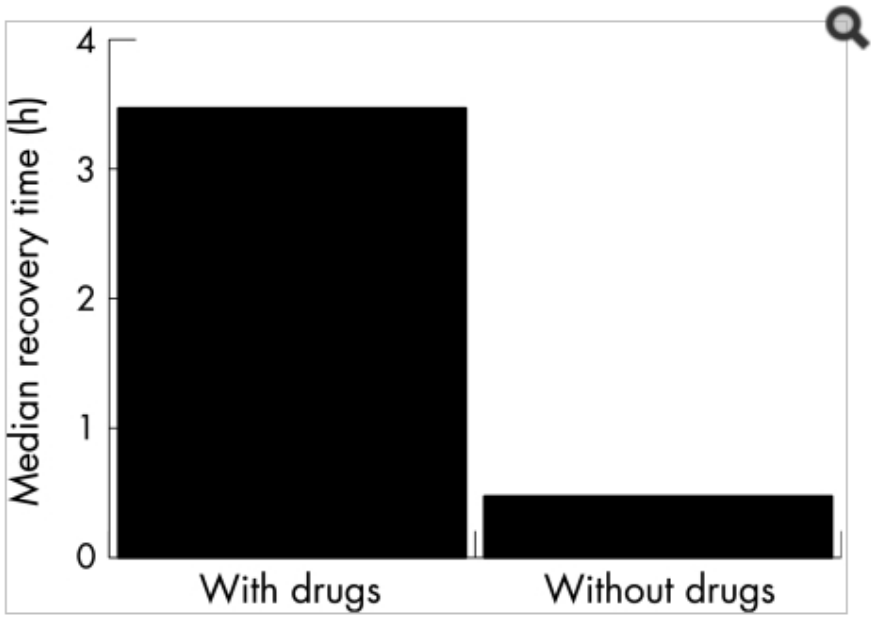


Figure 3 Median recovery time (h) versus rescue drugs (with drugs and without drugs).

Child with diagnosis of epilepsy

Get patient's weight and calculate exact dose per/kg they're getting – outgrowing dose common cause of seizures

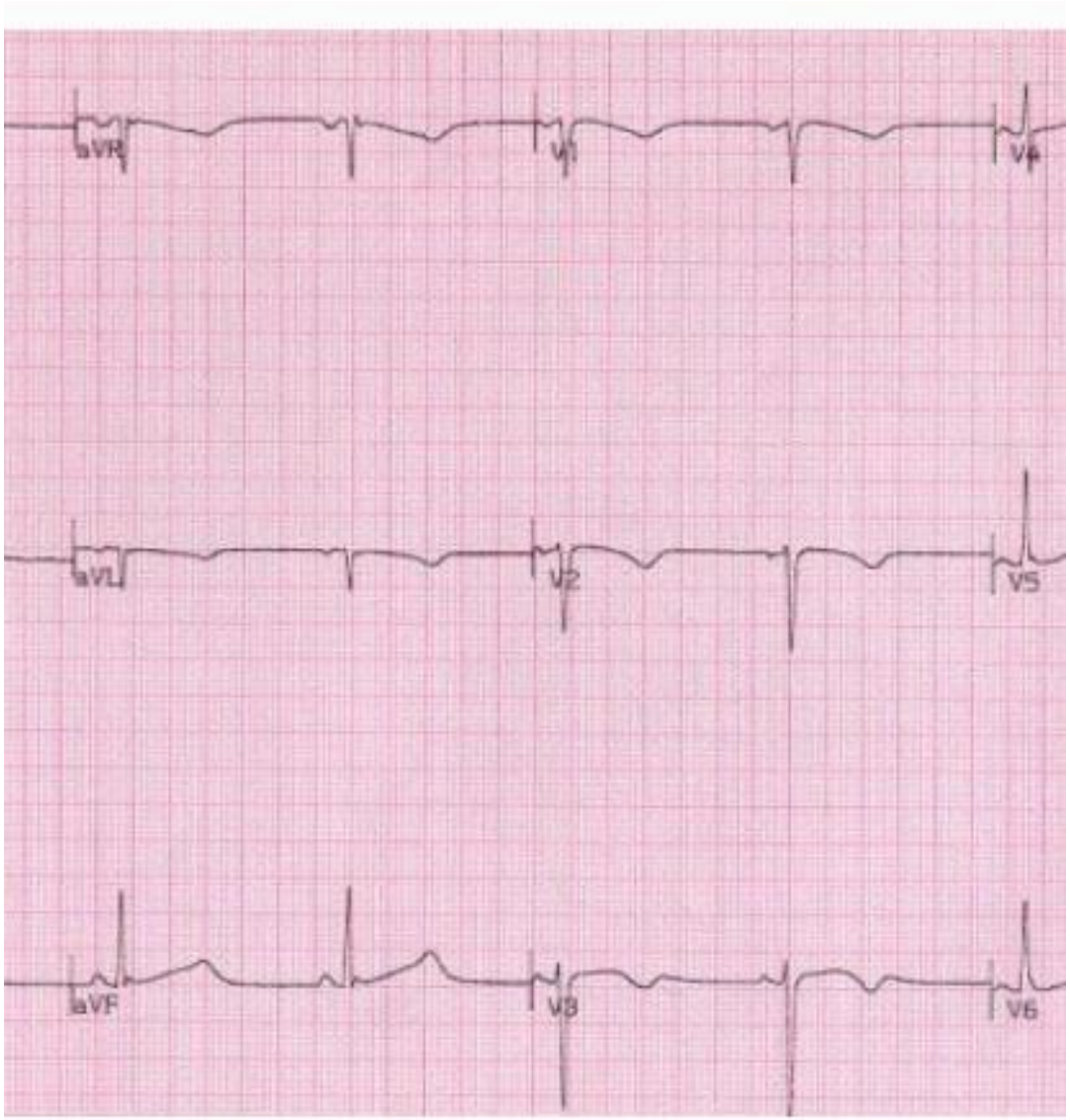
Children with complex needs – will often have complex regimens so always discuss with paediatrics and have low threshold to admit for observation (could they have aspirated?)

Minimum investigations

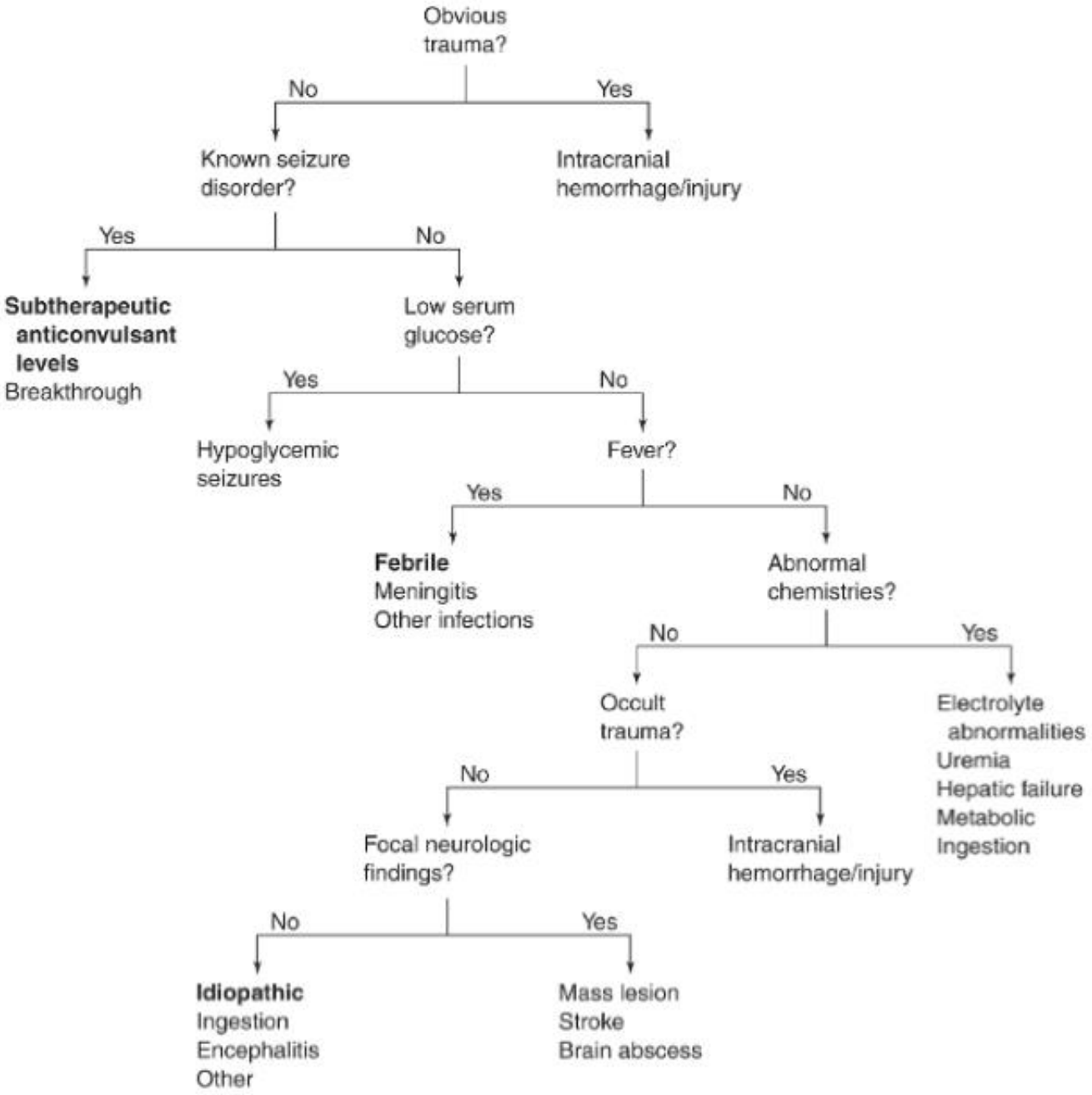
- ECG, looking for arhythymia, prolonged QT
- Electrolytes (Na, K+, Ca, Mg) – all but Mg can be gained from a blood gas

In well child, with normal examination, blood gas, ECG, with no focal signs or focal seizure, can be discharged pending clinic f/u and +/- EEG.

?head scans



QTc 550ms due to congenital long QT syndrome


Obvious trauma?
No
Yes
Known seizure disorder?
Intracranial hemorrhage/injury
Yes
No
Subtherapeutic anticonvulsant levels
Breakthrough
Low serum glucose?
Yes
No
Hypoglycemic seizures
Fever?
Yes
No
Febrile
Meningitis
Other infections
Abnormal chemistries?
No
Yes
Occult trauma?
Electrolyte abnormalities
Uremia
Hepatic failure
Metabolic
Ingestion
No
Yes
Focal neurologic findings?
Intracranial hemorrhage/injury
No
Yes
Idiopathic
Ingestion
Encephalitis
Other
Mass lesion
Stroke
Brain abscess

Indications for referral to the RMO1 for admission

- Age < 18 months & presenting acutely
- Reduced LOC > 1 hour post-termination of seizure (*see Guideline 7.6 also)*
- Prolonged seizure (e.g. duration > 10 mins or requiring emergency treatment)
- Focal seizure
- Recurrent seizures
- Signs of meningism, focal neurology or raised intracranial pressure
- Generally unwell
- Signs of aspiration
- High parent or carer anxiety
- Suspicion of NAI

Disposition

If sending the child home, must provide

Education:

- What is a seizure?

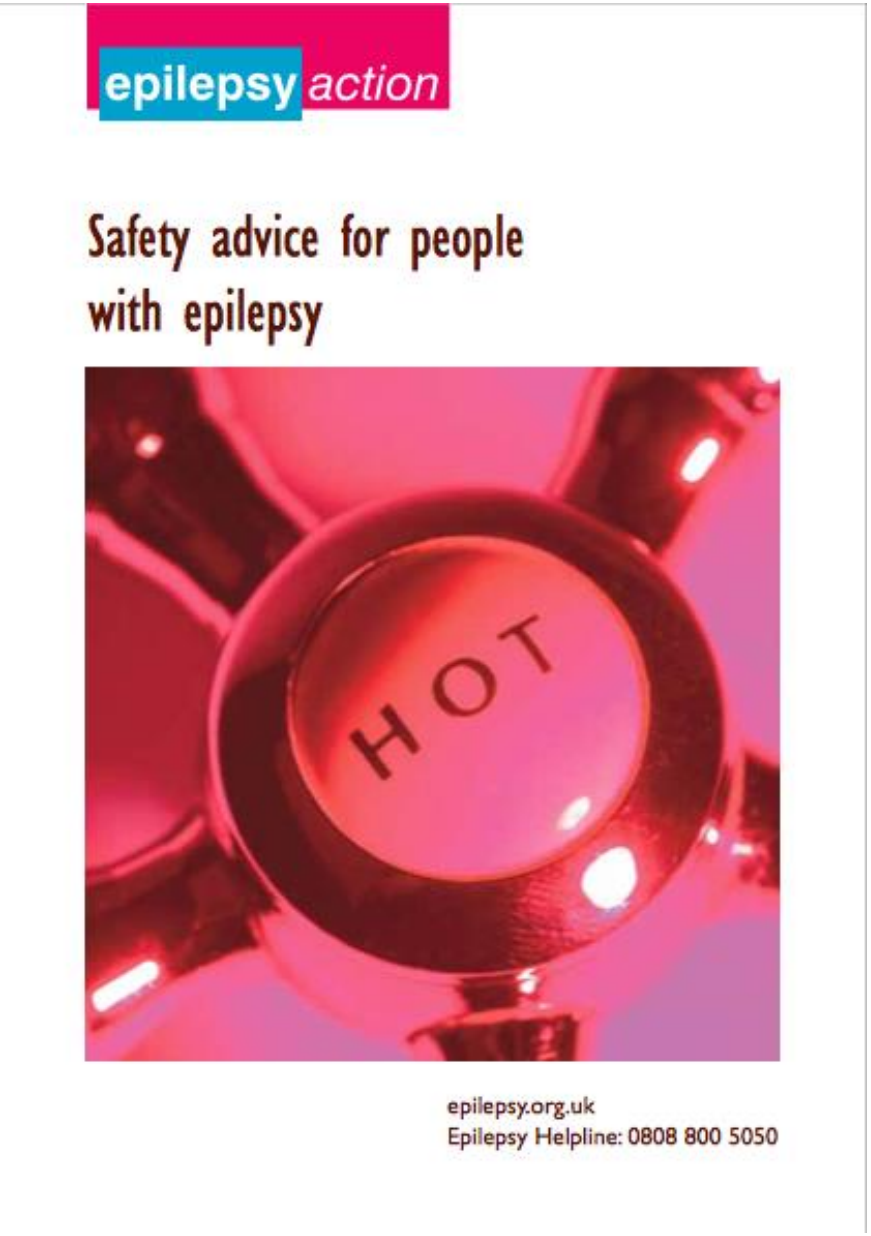
Approx 10% of the UK population will have at least one seizure at some point in their life.

After a first unprovoked epileptic seizure, 30-50% will recur.

First afebrile seizure does not mean a diagnosis of epilepsy

o Safety advice
o First aid for subsequent seizures

"How long should I wait to call an ambulance, doc?"



A **febrile seizure** (FS) is “an event in infancy or childhood usually occurring between 6 months and 5 years of age, associated with fever but without evidence of intracranial infection or defined cause for seizure.” (National Institute of Health).

- A **simple febrile seizure** is characterised by generalised tonic-clonic activity without focal features, of less than 10 mins duration, without a recurrence in the subsequent 24 hours and resolving spontaneously.
- Febrile seizures are common and occur in 2 – 5% of healthy children.
- Febrile status epilepticus (> 30 mins) occurs in 5% of children and accounts for 25% of all episodes of status epilepticus in children.

Risk of Recurrent Febrile Seizures

- Overall, 1/3 will experience a further FS.
- **Risk factors:**
  - First degree relative with FS (but not epilepsy).
  - Initial FS occurring with a relatively low fever.
  - Multiple initial seizures during same febrile episode.
- Recurrent FS tend to be prolonged if the initial FS was prolonged.

Risk of Epilepsy

- **Risk factors:**
  - Complex seizure.
  - Early onset neurodevelopmental abnormality.
  - Family history of epilepsy.
- **Risk of epilepsy:**
  - General population: 1.4%
  - FS: 2 - 4%
  - FS and risk factor: 10%
  - Prolonged FS: 21%
  - FS and all 3 risk factors: 49%

APPROACH TO THE CHILD FOLLOWING A FEBRILE SEIZURE

Points to cover in history:

- General health over past few days prior to seizure
- Presence/absence of fever (measured or subjective).
- Seizure description.
- Risk factors for meningitis (box 3).
- Family history of FS and epilepsy

Examination:

A full and thorough examination of the child should be performed, aiming to:

- Assess 'well being'
- Identify source of fever
- Identify signs of meningism

Investigations following a febrile seizure

- **Urine** For urinalysis ± M,C&S in all children without a clear focus for fever
- **BM** Only if fitting or prolonged drowsiness
- **Bloods** Not indicated routinely, only if specific additional indication
- **LP** If signs of meningism or consider if risk factor present (boxes 2 and 3)

RED FLAG FEATURES

Box 1

< 18 months age

or

Prior treatment with antibiotics

Box 2

Features of a complex FS:

1. **Multiple seizures in same illness**
2. **Focal features**
3. **Prolonged** (> 10 mins)

Box 3

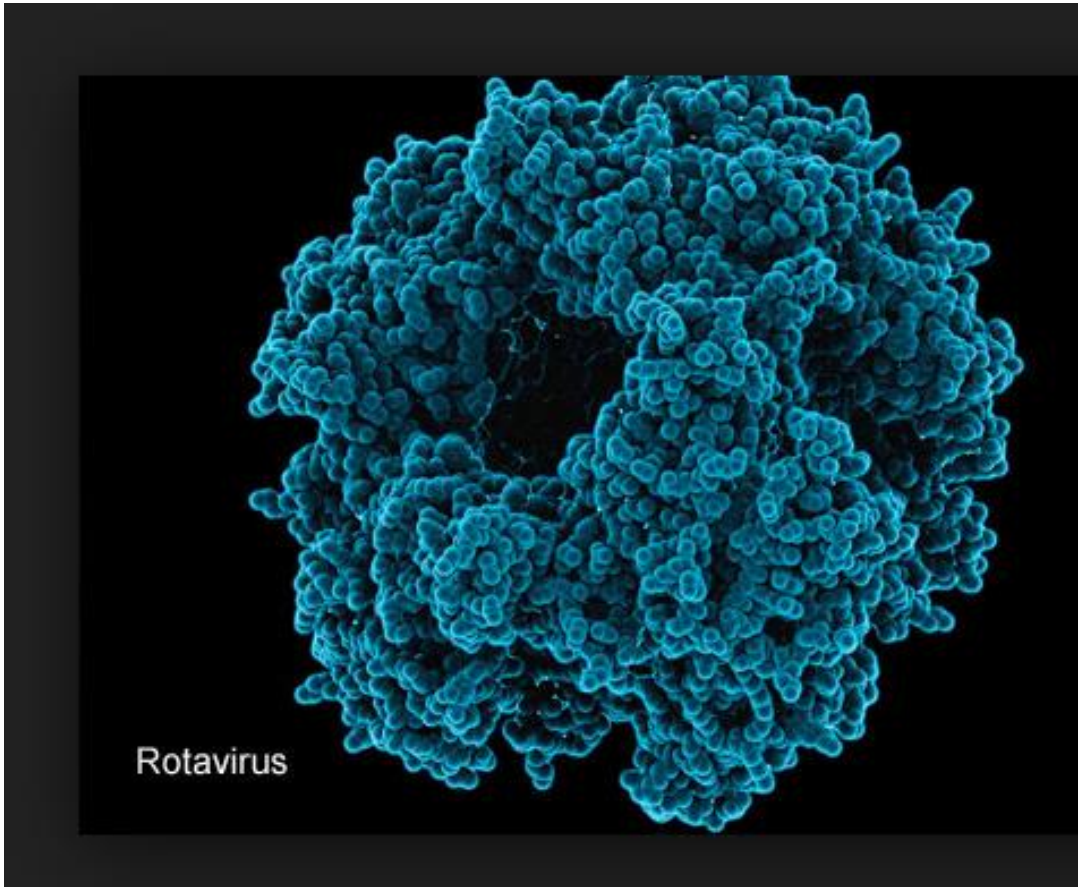
Other features associated with a small increased risk of meningitis:

1. **Drowsy before the seizure**
2. **> 3 days illness**
3. **GP contact in past 24 hours**
4. **Vomiting at home**
5. **Drowsy > 1 hour post-seizure**
6. **Dubious neck stiffness**
7. **Bulging fontanelle**

Convulsions with Gastroenteritis (CwG)

- Norovirus and rotavirus implicated
- Can occur with mild illness (without dehydration or electrolyte anormalities)

- Retrospective study at Osaka General Hospital showed 18 out of 293 childrebn admitted for gastroenteritis had seizures (12 Norovirus, 6 Rotavirus)
- 8 of the children did not have a fever



DIFFERENTIAL DIAGNOSIS OF PAROXYSMAL EVENTS

- Seizure disorders
- Psychogenic nonepileptic seizures
- (Pseudoseizures)
- Head trauma
  - Loss of consciousness
  - Posttraumatic seizures
- Syncope
  - Hypovolemia
  - Hypoxia
  - Reduced cardiac output
- Sleep disorders
  - Nightmares
  - Night terrors
  - Narcolepsy
  - Sleep apnea hypersomnia
  - Somnambulism
- Apparent life-threatening event
- Movement disorders
  - Paroxysmal choreoathetosis
  - Tic disorders
  - Shudder attacks
  - Benign myoclonus
- Psychiatric disorders
  - Daydreaming
  - Attention-deficit hyperactivity disorder
  - Panic attacks
- Gastrointestinal disorder
  - Sandifer syndrome (gastroesophageal reflux)
  - Abdominal migraines
  - Cyclic vomiting
- Breath-holding spells
  - Pallid
  - Cyanotic
- Atypical migraines

Resources

- Epilepsy Action https://www.epilepsy.org.uk very useful, clear information for patients and healthcare professionals
- Training video for giving buccal midazolam https://www.youtube.com/watch?v=mg2S5V_EjUA

References

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