Seizures

Seizure
Transient disturbance of cerebral function due to abnormal paroxysmal discharge from brain - paroxysmal involuntary motor activity/behaviour; 10% have at some point in lifetime; if cause found, 5% repeat; if no cause found, 50% repeat

Epilepsy
Recurrent primary seizures; 2+ seizures without acute provocation

Status Epilepticus
2+ seizures without full recovery between / 5mins continuous convulsive seizures
More common in children (1-3yrs; 50%), intellectual disability, >60yrs; occurs in 16% adults and 25% children with known epilepsy; 25% non-convulsive

Refractory status
Ongoing despite 2 anti-epileptics; refractory in 9-30%

Aetiology
Idiopathic; congenital; metabolic (hypoNa/Mg/Ca/G, phenylketonuria, ARF, inborn errors of metabolism); traumatic; SOL (13% new onset seizures 35-64yrs); vascular (haem, infarct, SAH, AVM; most common cause >65yrs); degenerative; infections (herpes, encephalitis, meningitis); drugs (stimulants, theophylline, TCA, withdrawal, isoniazid, tramadol, antitistamines, clozapine); anticonvulant compliance; sleep deprivation

In HI in children: immediate post-impact seizure is benign event

Pathophysiology

Phase I
Incr cerebral blood flow and metabolism; incr BP/HR/temp/WCC/glucose, lactic acidosis

Phase II
Onset of irreversible cerebral damage after 30mins; compensation fails
Hypotension, decr cerebral blood flow, hypoG, hypoxia, arrhythmia, cardiac/renal/hepatic failure, DIC, rhabdo; aspiration; pul oedema; cerebral oedema; hyperkalaemia

Classification

Partial
- Simple (most common, LOC preserved, aura common, focal motor/sensory, sensory, autonomic, psychic)
- Complex (altered LOC, déjà vu, automatic/dystonic behaviour, post-ictal confusion, evolve over secs-mins, last 1+ mins, aura; usually arise from temporal lobe; temporal slowing/sharp waves EEG)
- Secondary generalised

Generalised:
- Absence (sudden onset and offset, altered LOC few secs, no aura, no post-ictal confusion, occasional minor motor movements, short, precipitated by hyperventilation, spike+waves 3Hz EEG)
- Atypical absence (more gradual, more tonic)
- Myoclonic jerks
- Tonic-clonic seizures (altered LOC, cry, 30secs-2mins, post-ictal 30-60mins, mild headache; Todd’s paresis)
- Tonic (drop attacks)
- Clonic (large amplitude jerking of body parts)
- Atonic (head and facial injuries)

Status:
Generalised convulsive/non-convulsive (simple/complex partial, absence; consider if prolonged post-ictal)
Pregnancy
17% incr seizures during pregnancy in known epileptic
Valproate and carbamazepine - NTD
Decr risk by using single drug, split dosing to avoid peak, folic acid, vit K
Consider eclampsia if >20/40

Differential Diagnosis
Syncpe, migraine, movement disorders, sleep disorders, psych; causes above
**Pseudoseizure**: 70-80% women; non-synchronous movements, side-to-side head, averted eyes, pelvic thrusting, no cyanosis, no biting, loud, no post-ictal, positive avoidance manoeuvres
**Children**: infantile spasm (sudden brief flexion of arms, head and trunk, in clusters)
breath holding spells (after brief / vigorous cry, noxious stimulus)
others: benign neonatal sleep myoclonus; benign focal epilepsy of childhood; nocturnal frontal lobe seizures; night terrors; ALTE

Investigation 1st seizure
**FBC**: incr WBC common
**Biochem**: AGMA in post-ictal period suggests seizure; phos low due to consumption; incr prolactin
In status: Glu, U+E, Ca, Mg, drug screen, anticonvulsant levels, CK, ABG
**Drug screen**
**ECG**: looking for long QTc
**CT head**: do as OP if full recovery and no cause suggested
Indications for immediate CT: ?SOL, ongoing altered LOC, fever, recent HI, PMH Ca, anticoag, ?HIV, change in seizure pattern, >40yrs, partial onset seizure, focal
**LP**: if indicated; do if <6/12; lower threshold if on ABx
LP in first febrile convulsion: if you think it’s meningitis, trt and do LP when improve
**EEG**: positive in 70% if performed within 48hrs of seizure; only 50% epileptics will have abnormal 1st EEG; if normal in child, risk recurrence 12 months 15%, if abnormal, 40% risk; in status: helpful if non-tonic/pseudo

Management
O2, suctioning, coma position, trolley sides up, padded; treat cause

1. **Benzo’s**: anticonvulsant effects last 20-30mins; terminates status in 75-90%
Midazolam 5-10mg (0.15mg/kg IV/IN/buccal); onset 1-5mins, DOA 1-6hrs; more effective than diaz
Diazepam 10mg (0.25mg/kg IV or 0.5mg/kg PR) over 2-5min; onset 1-5mins, DOA 15-60mins
Lorazepam 2-4mg (0.1mg/kg); onset 1-5mins, DOA 12-24hrs, less SE
Clonazepam 1-2mg (0.008-0.016mg/kg) IV over 2-5mins
If no IV access / mentally handicapped / recurrent seizures: Paraldehyde 0.3mg/kg PR
2. Repeat benzos after 5mins
3. **Phenytoin**: 18mg/kg IV over 30mins (max 1g) - onset 10-30mins; terminates status in 45-90%; give full dose even if on PO; causes less sedation than benzos; must be on cardiac monitor
   SE: decr HR and BP (due to propylene glycol)
   CI: 2/3rd deg HB, absence
   or Fosphenytoin: 18mg/kg @ 150mg/min; can be given faster, less site reactions
   or (Adult) valproate: 400-800mg (30mg/kg) IV over 3-5mins - 5mg/kg/min infusion; less sedation
   or (Child) phenobarbitone 18mg/kg over 30mins (max 1g); onset 10-20mins; preferred if febrile illness/<2yrs/allergy to fosphenytoin; if resistant to benzo and pheny, likely resistant to this too as have same MOA; considered 4th line in adults
4. (Child) Phenobarb/fosphenytoin as above if other tried 1st
   (Child) Levetiracetam 20mg/kg

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5. **RSI** with (earlier if apnoea / hypoxia)

- **Sux** 1.5mg/kg IV +
- Thiopentone 2-5mg/kg IV - 2-4mg/kg/hr (max 6mg/kg/hr, titrate to effect); rapid onset, brief action; monitor with EEG; SE: decr RR

- Phenobarbitone 10-18mg/kg IV repeat bolus - 0.2-0.4mg/kg/min INF; ?adult dose; earlier in kids
- Propofol 1-2mg/kg - 5-10mg/kg/hr; rapid onset/offset
- (Child) Midazolam 0.15mg/kg IV bolus - 2mcg/kg/min INF (titrate up by 2mcg/kg/min incr Q5minly to max 24mcg/kg/min)
- Ketamine 1.5mg/kg IV - 0.01-0.05mg/kg/hr
- (Child) Na valproate as above (used earlier in adults)

Will need continuous EEG monitoring if paralysed

Consider  dextrose (2ml/kg 25% dex, 5ml/kg 10% dex)
- Ca (0.3ml/kg 10% Ca Glu over 5-10mins)
- Na (4-6ml/kg 3% NaCl, 20ml/kg N saline)
- Mg (50mg/kg over 20mins)
- pyridoxine

### Discharge

**Consider anticonvulsant**

**Education:** Re: safety, esp in children

**Driving:** single seizure on withdrawal of medications on medical advice: 3/12
- Sleep deprivation: 3/12
- Generalised seizure with illness: 3/12
- Isolated seizures, partial, recent diagnosis: 6/12
- While driving, seizure during normal waking hours: 1yr
- Psych illness/non-compliant with meds: 2yrs

### Prognosis

**RF for recurrence:** <50yrs, FH seizures, 2nd seizure within 1/52, SOL, prev neuro injury, abnormal EEG, seizure during sleep, Todd’s paresis; most recurrences occurs within 2yrs; 30% risk recurrence in children, 75% after 2nd seizure

**Status:** 22% mortality (3-8% in children)

### Maintenance outpatient therapy

- Phenytoin: generalised TC seiures, psychomotor seizures
- SE: nystagmus, ataxia, slurred speech, confusion, allergy, N+V+C, hepatotoxicity, haem, lymphadenopathy, gingival hyperplasia
- Carbamazepine (Tegretol): generalised TC seizures, partial seizures, chronic pain
- SE: ataxia, dizziness, sedation, SJS/skin reactions, blood dyscrasia, hepatotoxicity, SIADH
- Na valproate (Epilim): generalised TC seizures, partial
  - SE: decr plt, hepatotoxicity, incr NH3, teratogenicity
- Ethosuximide: absence only
  - SE: hepatotoxicity, blood dyscrasia, SJS, GI Sx
- Vigabatrin: difficult epilepsy
  - SE: visual field defect, psychosis, incr appetite
- Lamotrigine: generalised, partial
  - SE: SJS, TEN, aseptic meningitis
- Gabapentin: secondary generalised, partial, difficult epilepsy
- Levetiracetam: partial, myoclonic