Seizures occur in 1-3% of term newborn infants and in a greater proportion of preterm infants. They can be subtle, clonic, myoclonic or tonic

RECOGNITION AND ASSESSMENT

Physical signs
- In addition to obvious convulsive movements, look for:
  - apnoea
  - eye fluttering and deviation
  - staring
  - sucking, chewing, tongue thrusting
  - changes in blood pressure and heart rate
  - limb cycling/pedalling
- Perform a detailed examination and neurological assessment

Infants who have been given muscle relaxants may display only autonomic features (e.g. changes in blood pressure and heart rate) with or without changes in oxygen saturation

Differential diagnosis
- Jitteriness: tremulous, jerky, stimulus-provoked and ceasing with passive flexion
- Benign sleep myoclonus: focal or generalised, occurring only during sleep; EEG normal; resolves by 2 months of age

Investigations

First line
- Pulse oximetry
- Blood gas analysis
- FBC, coagulation
- Plasma glucose
- LFT
- CRP
- Serum electrolytes, including Ca$$^++$$ and Mg$$^{++}$$, PO$$^4$$
- Infection screen, including CSF
- Metabolic screen (plasma ammonia, lactate and amino acids, urine amino and organic acids)
- Cranial USS: if inconclusive or suggestive of haemorrhage, request further imaging
- Cerebral function monitoring

Second line
If seizures persist or difficult to control and first line investigations normal
- EEG
- MR scan (investigation of choice); CT scan of head if MR scan unavailable or haemorrhage suspected
- Drug screen (inform mother)
- If other signs:
  - congenital infection screen [(urine for CMV PCR, toxoplasma serology, throat swab in VTM (viral transport medium) for HSV)]
  - VLCFAs, biotinidase levels
  - Wood’s light
  - Ophthalmology review

TREATMENT
- Ensure ABC satisfactory

Causes
- Treat any underlying cause (e.g. hypoxia, hypoglycaemia, electrolyte abnormalities, infection)
- hypoglycaemia: give glucose 10% 5 mL/kg IV bolus, followed by maintenance infusion
Seizures 2009-11

- hypocalcaemia (total Ca <1.7 mmol/L or ionized Ca <0.64 mmol/L): give calcium gluconate 10% 2 mL/kg IV over 5-10 min with ECG monitoring (beware of tissue damage if extravasation: ensure cannula working well)
- hypomagnesaemia (<0.68 mmol/L): give magnesium sulphate 50% 0.2 mL/kg IM (also use for refractory hypocalcaemic fit)

**Prolonged fits**
If fits continue for >3 min, recur more than 3 times/hr or are associated with hypoxia:
- Give phenobarbital 20 mg/kg by IV bolus over 20 min
- if no response, give further 10 mg/kg by IV bolus over 10 min up to twice
- If response good, consider maintenance phenobarbital 4 mg/kg/day 24 hr after loading dose
- if loading dose in excess of 20 mg/kg required, defer maintenance dose for 3-4 days

If no response to phenobarbital after 40 mg/kg:
- Give phenytoin 20 mg/kg by IV infusion over at least 20 min (maximum 1 mg/kg/min) with ECG monitoring
- Give maintenance phenytoin 2 mg/kg by IV infusion every 8 hr

If no response to either phenobarbital or phenytoin:
- Give clonazepam 100 microgram/kg by IV bolus over 5-10 min, once every 24 hr for 2-3 days
- if treatment necessary for more than a few days, eventual withdrawal of clonazepam must be gradual over 3-6 weeks, tapering dosage to avoid risk of withdrawal seizures
- if clonazepam not available, give IV midazolam 200 microgram/kg followed by 60 microgram/kg/hr

**Breakthrough fits**
- If occasional breakthrough fits occur during maintenance treatment using any of the above agents:
  - consider paraldehyde 0.4 mL/kg PR mixed with equal volume of sodium chloride 0.9%/olive oil (0.8 mL/kg pre-mixed solution)

**Intractable fits**
For intractable fits with no apparent cause:
- Pyridoxine 100 mg IV over at least 5 min, but beware of neurological and respiratory depression following use in true pyridoxine-dependent seizures
- Lidocaine 2 mg/kg (0.2 mL/kg of 1% adrenaline-free lidocaine) over 1 hr IV increased to 4 mg/kg/hr if necessary

Avoid lidocaine if phenytoin previously administered. Risk of toxicity if lidocaine infusions continued >6 hr at a rate of 6 mg/kg/hr or >12 hr at lower doses (see Neonatal Formulary)

**SUBSEQUENT MANAGEMENT**
- Once free of seizures for 5 days and no need for continued maintenance, stop anticonvulsants
- withdraw most recently added drug first
- except for clonazepam, dosage need not be tapered
- Consider continued maintenance treatment with phenobarbital if seizures recur during or after withdrawal in infants with following conditions:
  - underlying CNS malformation
  - following severe HIE
  - meningitis
  - initial difficulty controlling fits
  - persisting clinical or EEG abnormalities

**DISCHARGE AND FOLLOW-UP**
- Arrange hearing test
- Outpatient follow-up at 6 weeks
- Long term follow-up for developmental assessment and monitoring of head growth
- No contraindication to vaccinations unless fits secondary to a progressive neurological disorder
- Arrange MR scan of brain if not already done, and no cause identified on initial investigations