Name of Disorder: Neonatal Seizures
Essay Title: Seizures in the newborn baby
Author: Dr Tracey Bjorkman BSc MPhil PhD
Institution: The University of Queensland
Date: 26/06/2014

Description
Seizures are more common in the neonatal period (babies up to 28 days old) than at any other time in human life. This is not unusual though given that the brain is developing at an amazing pace during this time. However the occurrence of seizures as a newborn infant can be associated with significant risk of later life neurological problems and physical and mental disability and should be thoroughly investigated. As many as 5 per 1000 newborn babies are at risk of seizures (this is higher if you are born pre-term), however it is not clear how many babies actually suffer neonatal seizures and the true incidence is likely to be higher

Neonatal seizures are among the most prominent and distinctive signs of serious neurological dysfunction in a newborn baby and can result from a wide variety of underlying disorders. A lack of oxygen and blood flow to the babies brain around the time of birth, due to issues such as placental abruption (when the placenta comes away from the uterine wall) or obstruction of the umbilical cord, is the most common cause of seizures and is responsible for up to 50% of all neonatal seizures. Other reasons for neonatal seizures can include:

- stroke
- intracranial haemorrhage (bleeding in the brain)
- developmental defects
- infection
- metabolic disease or deficiencies
- genetic causes (benign familial neonatal seizures)

Unlike seizures in children and adults, seizures in the newborn baby are much less obvious and often very difficult to detect unless the brain is also monitored with an EEG (electroencephalogram which measures normal brain activity and can detect abnormal activity such as seizures). In fact more than 80% of all neonatal seizures are silent, that is there is no physical or clinical sign, and cannot be diagnosed without the aid of EEG monitoring. Physical seizures in newborns are quite subtle but can include:

- Deviation of the eyes
- Repetitive blinking or fixed gaze (staring)
- Repetitive mouth or tongue movements (chewing or lip smacking)
- Grimacing or crying like gestures
- Periods of apnoea (baby stops breathing)
- Limb movements
  - Clonic seizures - rhythmic jerking that resemble pedalling or cycling type movements
- Tonic seizures – where the muscles tighten and the limb appears to be outstretched
- Myoclonic seizures - sudden jerks of individual limbs or the whole body

A number of these types of movements (jitteriness) however are also present in a normal newborn baby and can be misinterpreted as neonatal seizures. If by moving the baby into a different position the seizure activity stops then it is unlikely to be a seizure. However if the movement persists despite changing or shifting the baby, seizures should be suspected and confirmed by EEG monitoring.

Full channel video-EEG monitoring (many electrodes covering the baby’s head) is considered the gold standard for identifying seizures and for diagnosis; however this is not routinely available in many hospitals and requires the expertise of a paediatric neurologist. Amplitude-integrated EEG (aEEG) monitoring (less electrodes) allows long-term bedside monitoring and is relatively easy to apply and interpret and should be utilised in the absence of the availability of full channel video-EEG.

**Treatment**

It is important to identify the underlying reason for neonatal seizures. Depending on the underlying cause however, most neonatal seizures are treated with antiepileptic drugs (AEDs). The primary standard drug therapies include:

- Phenobarbitone
- Phenytoin
- Midazolam/Lorazepam/Clonazepam

Other AED’s such as lidocaine, topiramate, levetiracetam, vigabatrin and lamotrigine are also used. There are also a number of other therapies that are currently being investigated as AED treatments that are specific and possibly more effective for the developing newborn brain.

**Prognosis**

It is still largely unclear what effect seizures have on the developing newborn brain but there is evidence that outcomes following seizures in the neonatal period can be poor; frequent or prolonged seizures may result in long-term neurodevelopmental problems. Presence of seizures during the neonatal period, especially if associated with a serious underlying disease, have been shown to result in permanent impairments to learning, memory and cognition in up to 47% of survivors. Neonatal seizures also carry a high risk of developing epilepsy and seizures in later life and have also been linked with cerebral palsy and in the most serious cases death.

Unfortunately while there are a number of AED treatments for neonatal seizures, they are relatively ineffective. These AEDs result in relatively good seizure control in the adult and child but neonates respond poorly to these same AED treatments. The first-line treatment phenobarbitone is effective in less than 50% of cases. Where seizures do not respond to this first-line treatment, doctors will move to the second line treatment and so on in a bid to control seizure activity. There is increasing evidence that seizures are particularly harmful to the newborn brain thus it is vital to rapidly identify and diagnose neonatal seizures so that appropriate care can be implemented.
There are several factors that may account for a lack of adequate seizure control in the newborn baby and should be considered in the development of age-appropriate treatments as there is evidence to suggest that conventional treatments may also do more harm than good in the newborn brain. Clinical/physical seizures remain the target of clinical management in many hospitals however confirmation by EEG should be sought.

The lifelong consequences of neonatal seizures can be significant with substantial personal and financial burdens on families and society. There is a clear need to improve identification and monitoring of seizures as well as development of suitable treatments for babies with seizures in the first few days and weeks of life. Detection and management of neonatal seizures is a major clinical challenge worldwide however with better surveillance and treatment of neonatal seizures better outcomes for these babies is possible.

References: