# CONVULSION

**Involuntary contraction or series of contractions of the voluntary muscles, occurs due to disturbances of the brain functions resulting from abnormal excessive electrical discharge from the brain, manifested by involuntary motor, sensory, autonomic phenomena, alone or in combination, & also associated with altered level of consciousness.**

# Also termed as Seizure…

**A seizure in the neonatal period is an emergency that reflects potentially significant insults to the immature brain.**

**Diagnostic and therapeutic interventions should thus be established promptly.**

# Seizure…

- More commonly found in infants & children
- Is a symptom found in various diseases
- Incidence in childhood is about 8%
- More commonly found along with cerebral palsy(35%) & mental retardation(20%)
- Neonate – twitching of limbs, fluttering of eyelids, conjugate deviations of eyes or as sucking movements

# Seizure…

- 1. Epileptic seizures: phenomena associated with corresponding EEG seizure activity e.g. clonic seizures
- 2. Non-epileptic seizures: clinical seizures without corresponding EEG correlate e.g. subtle and generalized tonic seizures
- 3. EEG seizures: Abnormal EEG activity with no clinical correlation.

# Type – Generalised : Partial

- **Generalised**

1. **Tonic-Clonic (Grandmal)**
2. **Absence Seizure (Petitmal) –**

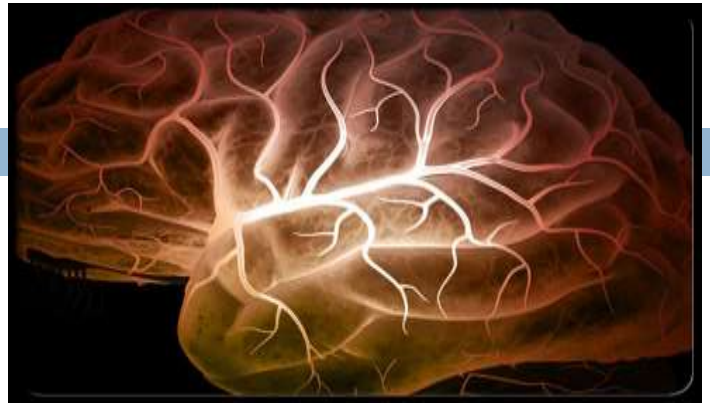
   **i) typical  ii) atypical**
3. **Atopic seizure**
4. **Myoclonic**

## Partial Seizure

1. Simple partial with no impaired consciousness (Jacksonian)
2. Complex partial with impaired consciousness

Convulsion should be differentiated from tremor, jitteriness, startle response to stimuli & sudden jerks

# Causes of convulsive disorder in children…



- **Neonatal period**
  - → **Birth asphyxia, hypoxia, birth injury, IVH**
  - → **Hypoglycemia, hypocalcaemia, hypo/hypernatremia, hypomagnesaemia**
  - → **Narcotic drug withdrawal, accidental injection of local anesthetic drug into fetal scalp**
  - → **Intrauterine infections; Septicemia, kernicterus, meningitis, tetanus**
  - → **Congenital malformations—microcephaly, porencephaly**
  - → **Pyridoxin defifiency, inborn errors of metabolism**

# In infants & young children

→ febrile convulsion

→ CNS infections- Meningitis, Encephalitis, cerebral malaria, Tetanus

→Acute viral infections- Mumps, Measles

→ Post vaccinal encephalopathy (Pertussis vaccination)

→ Metabolic disorder – dyselectrolemia, dehydration, alkalosis, hypoglycemia, inborn errors of metabolism

→ Traumatic (Accidental / non-accidental injury)

→ SOL in Brain— tumor, abscess

# Contd…..

→ Vascular – ICH, DIC, HTN

→ Drugs & poisons – phenothiazine, diphenylhydantin

→ Miscellaneous – heat stroke, acute cerebral edema, allergy

→ Idiopathic

# EPILEPSY

**Recurrent, episodic, paroxysmal transient disturbances of brain function due to abnormal electrical activity of neurons.**

**Epilepsy refers to a pattern of chronic seizures of any type over a long period.**

# Pathophysiology

**Prolonged depolarization**

**Brain cells over-activity**

**Cells discharge in a sudden violent disorderly manner**

**Electrical energy spreads to adjacent areas of brain**

**seizure**

# Generalised Seizure…most frequent form of childhood seizure

- Abrupt onset
- Classical form has 4 phases
  - Aura
  - Tonic spasm
  - Clonic phase
  - Postictal phase

# Aura …

**A peculiar sensation with dizziness occurs before tonic-clonic seizure.**

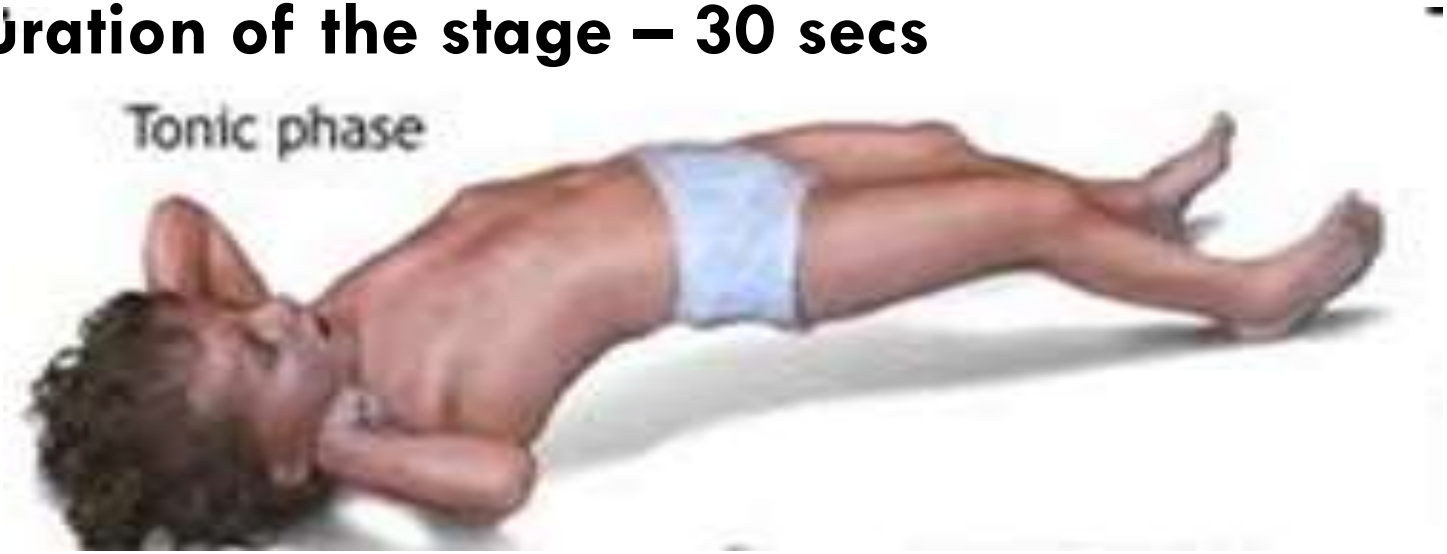
**It is a transitory symptom**

# Tonic spasm phase—due to muscular spasm & rigidity…

- Child's entire body becomes stiff
- Face may become pale & distorted
- Eyes fixed in one position
- Back may be arched
- Head turned to backward or in one side
- Arms are usually flexed & hands are clenched
- Child fall on ground from standing or sitting position
- Peculiar piercing cry
- Loss of consciousness, frothy discharge from mouth

# Tonic spasm phase contd…

- Spasm of respiratory muscles – ineffective breathing & cyanosis
- Pulse may become weak & irregular
- Duration of the stage – 30 secs



# Clonic phase…


- Rythmic jerky movements due to alternating contractions of muscle groups following the tonic state, which usually start in one part & became generalized including the facial muscles
- Child may pass urine & stool involuntarily
- May have tongue & cheek bite due to sudden contraction of abdominal muscles & jaw
- Duration – few minutes to few hours!!

  (status epilepticus)

# Postictal/Postconvulsive state…

- Usually child become sleepy
- Confused
- Exhausted
- Perform automatic actions
- Complain headache
- May not be able to recall the episode
- May develop paresis ( rare )

# Absence Seizure (Petit mal)

- Rare before 5 yrs of age
- Child may loss contact with envir for a few secs.
- Staring or day dreaming
- Discontinue activity suddenly

  ( reading, writing) & may resume the same when seizure is over
- Atypical seizure may be as rolling of eyes, nodding of head, slight hand movement, smacking of lips

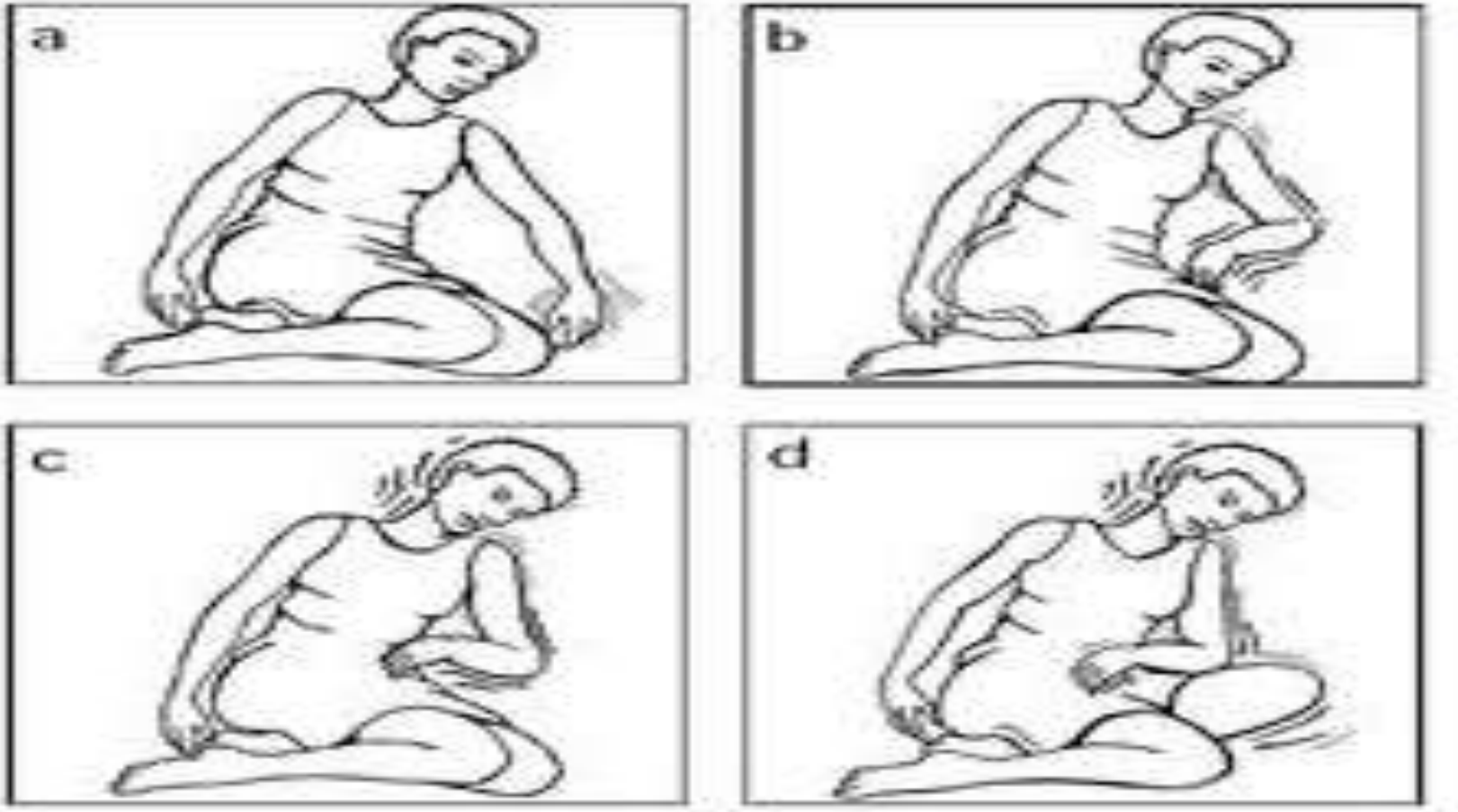
- Child appear normal & not aware of episode in post-ictal state
- Duration usually 5-10 secs.
- Frequency – one to hundred timed/day
- Precipitating factors– hyperventilation, fatigue, hypoglycemia,& stress situation

# Absence Seizure

# Myoclonic Seizure (Infantile Spasm)

- Occurs in infants usually between 3-8months age
- Almost always associated with cerebral abnormalities & mental retardation
- Child presents with sudden forceful myoclonic contractions involving the muscles of trunk, neck & extremities
- Contractions can be flexor/extensor/mixed type
- Duration is usually <1month
- Frequency may vary from a few to100 attacks/day
- Usually disappear spontaneously by the age of 4 yrs.

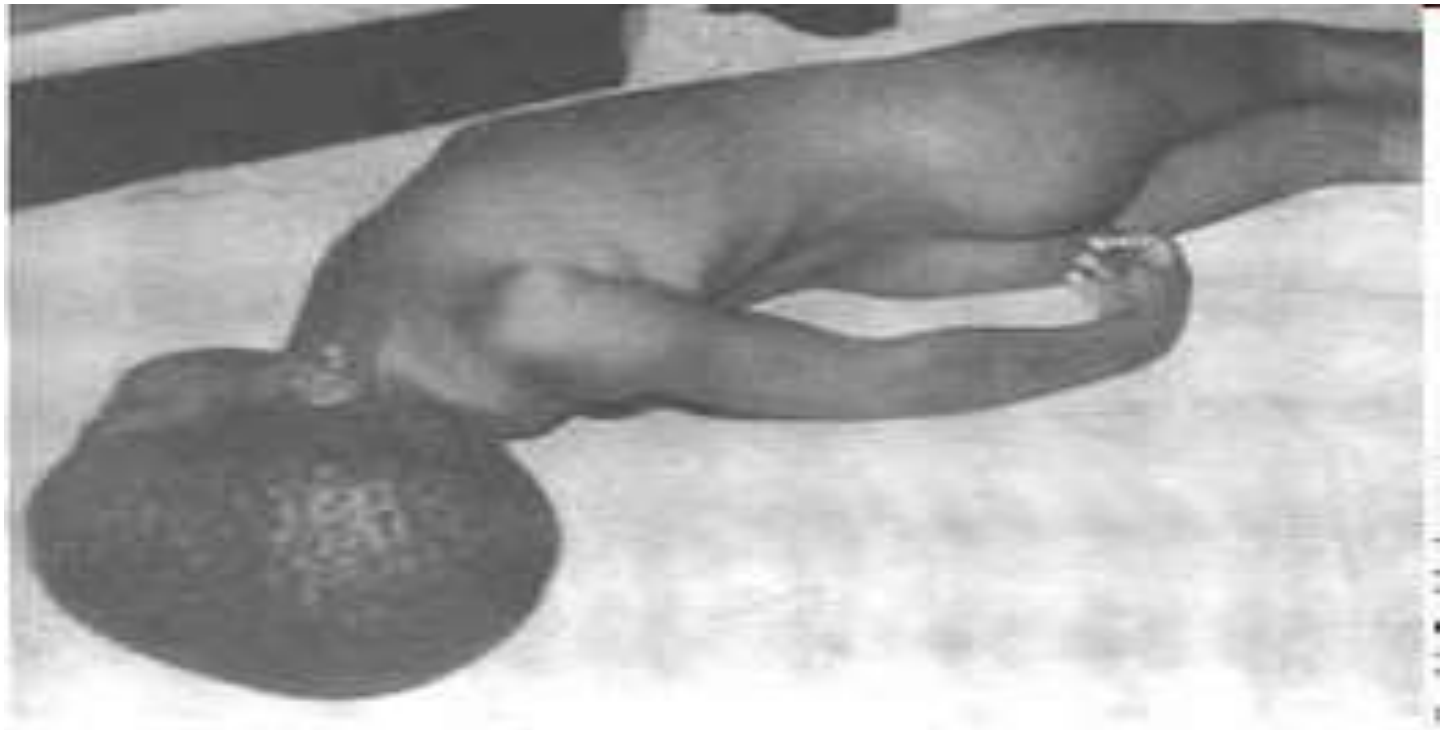
# Partial Seizure…A simple partial seizure with motor symptoms



# Partial Seizure…..

- Accounts for 60% of convulsive disorders in children
- Common causes – birth asphyxia, head injury, neoplasm, atrophic lesions etc.

# Subtle **convulsion** in a **child** with cerebral malaria.



# Types of seizure

| Seizure type | Occurs in | Clinical signs | EEG changes |
|---|---|---|---|
| Subtle | Preterm & term | Eye deviation (term); Blinking, fixed stare(preterm); repetitive mouth & tongue movements; apnea; tonic posture of limbs | Usually no |
| Tonic | Primarily preterm | May be focal or generalised; tonic extension or flexion of limbs | Usually no |
| Clonic | Primarily term | May be focal or multifocal; clonic limb movements (synchronous /asynchronous) | Yes |
| Myo clonic | Rare | focal, multifocal or generalized; lightning like jerks of extremities | + - |

**Around 3% of all children have a seizure when younger than 15 years, half of which are febrile seizures (seizure brought on by a fever).**

- A **febrile seizure** occurs when a child contracts an illness such as an ear infection, cold, or chickenpox accompanied by fever.
- Febrile seizuresare the most common type of seizure seen in children.
- Two to five percent of children have a febrile seizure at some point during their childhood.
- Why some children have seizures with fevers is notknown, but several risk factors have been identified.

- Children with relatives, especially brothers and sisters, who have had febrile seizures are more likely to have a similar episode.

- Children who are developmentally delayed or who have spent more than 28 days in a neonatal intensive care unit are also more likely to have a febrile seizure.

- One of 4 children who have a febrile seizure will have another, usually within a year.

- Children who have had a febrile seizure in the past are also more likely tohave a second episode.

- Neonatal seizures occur within 28 days of birth.
- Most occur soon after the child is born.
- They may be due to a large variety of conditions.
- It may be difficult to determine if a newborn is actually seizing, because they often do not have convulsions. Instead, their eyes appear to be looking in different directions.
- They may have lip smacking or periods of no breathing.

- **Status epilepticus is either a seizure lasting longer than 30 minutes or repeated seizures without a return to normal in between them.**
- **It is most common in children younger than 2 years, and most of these childrenhave generalized tonic-clonic seizures.**
- **Status epilepticus is very serious.**

# Diagnosis/Approach

***Seizure history*:**

- *associated eye movements,*
- *restraint of episode by passive flexion of the affected limb,*
- *change in color of skin (mottling or cyanosis),*
- **whether the infant was conscious/ sleeping at the time of seizure,**
- **The day of life (day 0-3 may be related to perinatal asphyxia, intracranial hemorrhage, metabolic and developmental defects; day 4-7 may be due to sepsis, meningitis, metabolic causes and developmental defects)**

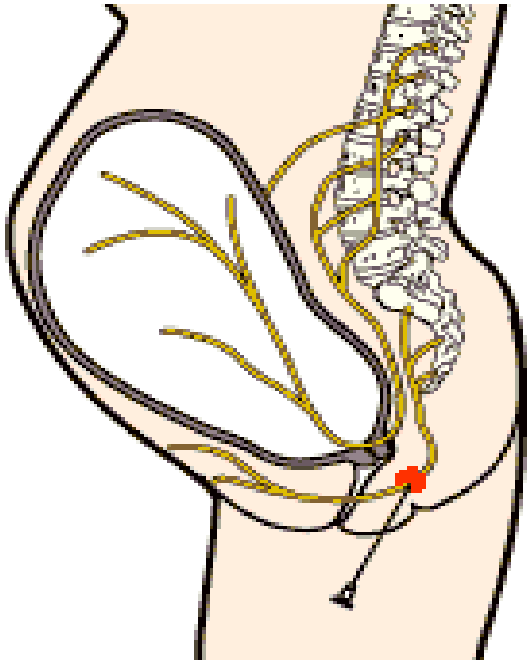
## ***Antenatal history:***

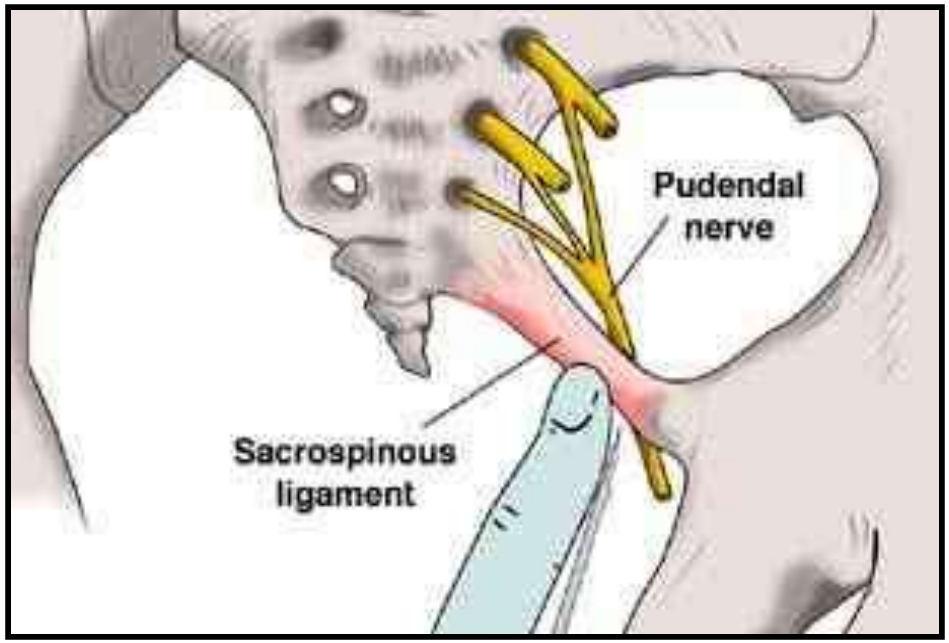
- intrauterine infection,
- maternal diabetes
- narcotic addiction
- sudden increase in fetal movements

# ***Perinatal history:***

- **Perinatal asphyxia**
- **fetal distress,**
- **decreased fetal movements,**
- **instrumental delivery,**
- **need for resuscitation in the labor room,**
- **low Apgar scores (<3 at 1 and/ or 5 minutes) and abnormal cord pH (≤7) and base deficit (> 10 mEq/L)**
- **Use of a pudendal block for mid-cavity forceps may be associated with accidental injection of the local anesthetic into the fetal scalp**

# Pudendal block - provides anesthesia for episiotomy and low forceps delivery ; vaginal approach is usually preferred ; each pudendal nerve is blocked as it passes under and slightly posterior to the ischial spine (S2,3,4)





## ***Feeding history:***

- **lethargy, poor activity, drowsiness, and vomiting after initiation of breast-feeding (Inborn Errors of metabolism)**
- **Late onset hypocalcaemia in the presence of top feeding with cows' milk.**

- ***Family history:***

- consanguinity in parents, family history of seizures or mental retardation and early fetal/neonatal deaths
- inborn errors of metabolism

# Examination

- ***Vital signs:*** **Heart rate, respiration, blood pressure, capillary refill time and temperature**
- ***General examination*****: Gestation, birth-weight and weight for age**
- ***CNS examination*** **: Presence of a bulging anterior fontanels is suggestive for meningitis or intracranial hemorrhage; assessment of consciousness (alert/ drowsy/ comatose), tone (hypotonia or hypertonia)**

# *Mandatory investigations*

- **blood sugar,**
- **hematocrit,**
- **bilirubin (if jaundice is present clinically),**
- **serum electrolytes (Na, Ca, Mg)**
- **arterial blood gas,**
- **cerebrospinal fluid (CSF) examination,**
- **cranial ultrasound and electroencephalography (EEG)**

- Neurosonography
- CT scan
- MRI scan
- TORCH screen and VDRL
- metabolic screen includes blood and urine ketones, urine reducing substances, blood ammonia, anion gap, urine and plasma aminoacidogram, serum and CSF lactate/ pyruvate ratio

# Treatment

***Initial medical management*:**

- nurse the baby in thermoneutral environment
- ensure airway, breathing and circulation
- O2
- IV access
- brief relevant history
- quick clinical examination

- ***Hypoglycemia*: 2 ml/kg of 10% dextrose should be given as a bolus injection followed by a continuous infusion of 6-8 mg/kg/min.**
- ***Hypocalcemia*: 2ml/kg of 10% calcium gluconate IV over 10 minutes under strict cardiac monitoring**

  **If seizures continue despite correction of hypocalcemia, 0.25 ml/kg of 50% magnesium sulfate should be given intramuscularly (IM)**
- **Exchange transfusion(bilirubin encephalopathy, metabolic disorders)**
- ***Anti-epileptic drug therapy (AED)***

# Pharmacotherapy for neonatal seizures

***Phenobarbitone***

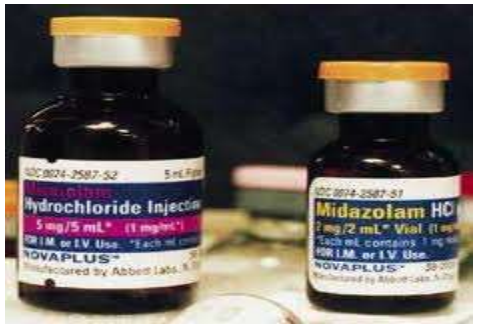
- **20 mg/kg/IV slowly over 20 minutes (not faster than 1 mg/kg/min). If seizures persist after completion of this loading dose, repeat dose of phenobarbitone 10 mg/kg may be used every 20-30 minutes till a total dose of 40 mg/kg has been given. The maintenance dose is 3-5 mg/kg/day in 1-2 divided doses, started 12 hours after the loading dose.**

## *Phenytoin*


- **20 mg/kg IV at a rate of not more than 1 mg/kg/min under cardiac monitoring. Phenytoin should be diluted in normal saline as it is incompatible with dextrose solution. A repeat dose of 10 mg/kg may be tried in refractory seizures. The maintenance dose is 3-5 mg/kg/d (maximum of 8 mg/kg/d) in 2-4 divided doses.**

## ***Benzodiazepines***

- ***· Diazepam: 0.25 mg/kg IV bolus (0.5 mg/kg rectal); may be repeated 1-2 times.***
- ***· Lorazepam: 0.05 mg/kg IV bolus over 2-5 minutes; may be repeated***
- ***· Midazolam: 0.15 mg/kg IV bolus followed by infusion of 0.1 to 0.4 mg/kg/hour.***
- ***· Clonazepam: 0.1–0.2 mg/kg IV bolus followed by infusion 10-30 mg/kg/hr.***



# *Antiepileptic drugs for seizures refractory to above treatment …*

- **Lidocaine** (start 4mg/kg/hr IV on first day, reduce by 1mg/kg/hr on each subsequent day; should not be administered with phenytoin)
- **Paraldehyde** (0.1-0.2ml/kg/dose IM; 0.3ml/kg/dose mixed with coconut oil in 3:1per rectal-after 30 min. & 4-6 hrly.)
- **Sodium valproate** ( 20-25mg/kg/day IV followed by 5-10mg/kg every 12 hrs.)
- **Vigabatrin** ( 50mg/kg/day)
- **Topiramate** ( 3mg/kg)

# *Maintenance anti-epileptic therapy*

- **Monotherapy**

- **Attempts should be made to stop all anti-epileptic drugs and wean the baby to only phenobarbitone at 3-5 mg/kg/day**

- **If seizures are uncontrolled or if clinical toxicity appears, a second Anti Epileptic Drug may be added (choice may vary from phenytoin, carbamazepine, and valproic acid )**

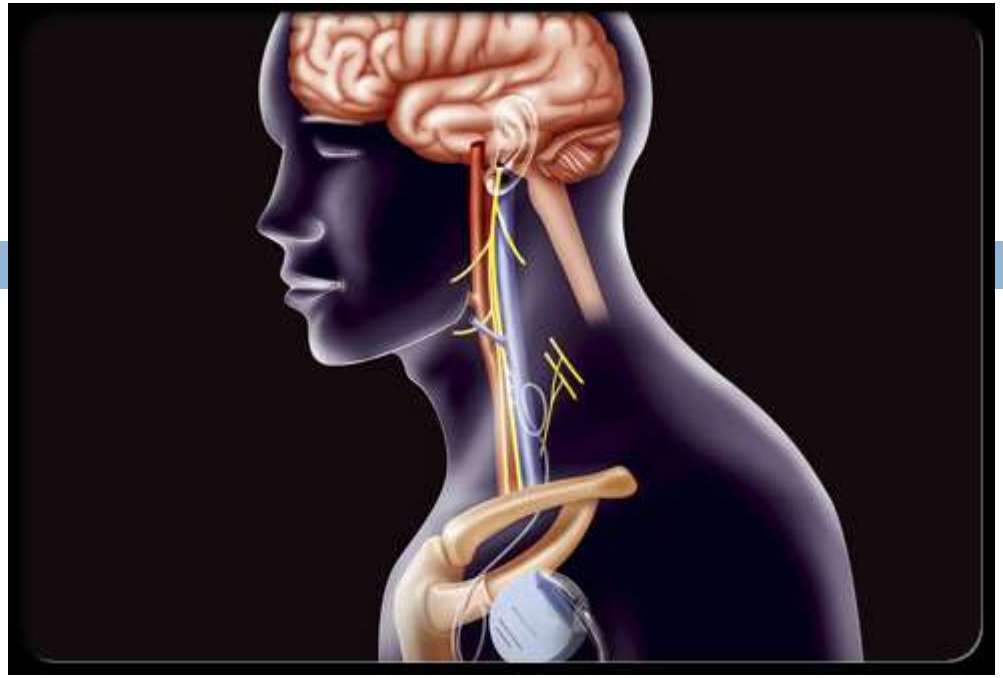
# Discontinuation of Anti Epileptic Drug (AED)

- Highly individualized
- No specific guidelines available
- Try to discontinue all medication at discharge if clinical exam. Is normal
- Continued when neurological findings persistently abnormal & baby is reassessed at 1 month
- If normal – AED discontinued over 2 wks – reassessment
- If not normal – EEG – not overtly paroxysmal –AED tapered & stopped
- EEG abnormal – baby reassessed at 3 months – then 3 monthly till 1 year of age.

# Other therapies….


- **Pyridoxine –**
  - IV is preferred
  - But suitable IV preparations are not available at present in INDIA
  - Hence IM Neurobion 1ml(50mg pyridoxine) in gluteal/anterolateral aspect of thigh
  - Ideally done in NICU as hypotension & apnea can occur

- **Exchange Transfusion –**
  - Indicated in life threatening metabolic disorder, accidental injection of local anaesthetic, transplacental transfer of maternal drugs (chlorpropamide) & bilirubin encephalopathy.



- VNS stands for vagus nerve stimulation, a treatment that is sometimes called a "pacemaker for the brain." It uses a small surgically implanted device to send electrical pulses to the brain. The pulses travel via the vagus nerve, a large nerve in the neck. VNS is an option for people who don't do well with medication.

- In people who have partial seizures, surgery can sometimes offer a cure. First, the medical team must determine that the seizures consistently begin in a single area of the brain. If so, removing this area may stop the seizures for good or make them easier to manage with medication. Surgery may also be done to treat an underlying condition that's causing seizures, such as a brain tumor.

# Self-Care at Home

- Time the seizure with your watch.
- Help the child to lie down.
- Remove glasses or other harmful objects in the area.
- Loosen anything at the neck that may impair breathing.
- Do not try to put anything in the child's mouth. In doing so, you may injure the child or yourself.
- Immediately check if the child is breathing. Call to obtain medical assistance if the child is not breathing.
- Turn the child (if possible) onto his or her side.
- Put something soft beneath the head.

# Contd…

- **After the seizure ends, place the child on one side and stay with the child until he or she is fully awake.**
- **Observe the child for breathing. If he or she is not breathing within 1 minute after the seizure stops, then start mouth-to-mouth rescue breathing (CPR).**
- **Do not try to do rescue breathing for the child during a convulsive seizure, because you may injure the child or yourself.**

# Contd…

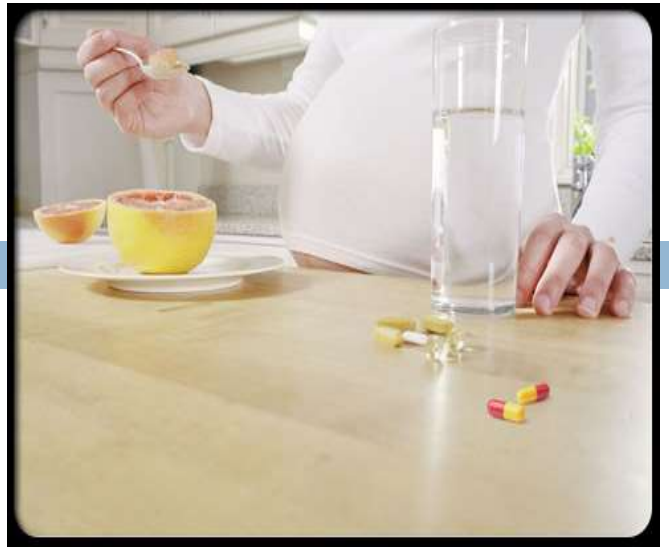
- **If the child has a fever, acetaminophen (such as Tylenol) may be given rectally.**
- **Do not try to give food, liquid, or medications by mouth to a child who has just had a seizure.**
- **Children with known epilepsy should also be prevented from further injury by moving away solid objects in the area of the child, using special helmet to protect the head.**
- **If you have discussed use of rectal medication (for example, Valium) with your child's doctor, give the child the correct dose.**

- When followed carefully, a ketogenic diet can eliminate or nearly eliminate seizures in a third of children with epilepsy who try it. The diet is very high in fat and low in carbs, a combination that makes the body burn fat instead of sugar. This creates changes in the brain that reduce or eliminate seizures. It's a very strict diet that is created by a dietitian and monitored by a medical team. It may be recommended when medications fail or cause unacceptable side effects.

# Prevention ..

- **Most seizures cannot be prevented.**
- **Children who are known to have febrile seizures should have their fevers well controlled when sick.**
- **prevent further injury**
- **The child can participate in most activities just as other children do.**
- **Parents and other caretakers must be aware of added safety measures, such as having an adult around if the child is swimming or participating in any other activities that could result in harm if a seizure occurs.**
- **One common area for added caution is in the bathroom. Showers are preferred because they reduce the risk of drowning more than baths.**

# Epilepsy and Pregnancy



- In most cases, it is safe for women with epilepsy to become pregnant and start a family.
- More than 90% of babies born to women with epilepsy are healthy.
- However, it's best to consult your doctor before getting pregnant.
- It may be necessary to adjust your anti-seizure medication.
- Some drugs appear to be less risky during pregnancy than others.

# Outlook ….

- The prognosis for children with seizures depends on the type of seizures.
- Most children do well, are able to attend regular school, and have no limitations.
- The exceptions occur with children who have other developmental disorders such as cerebral palsy and in children with neonatal seizures and infantile spasms.
- Many children "outgrow" seizures as their brains mature. If several years pass without any seizures, doctors often stop the child's medications and see if the child has outgrown the seizures.

- A seizure in general is not harmful unless an injury occurs or status epilepticus develops. Children who develop status epilepticus have a 3-5% risk of dying from the prolonged seizure.

- Children with febrile seizures "outgrow" them, but theyoften have repeated seizures when they develop fevers while they are young.

# Living With Epilepsy…

People with epilepsy can enjoy full, active lives. Most are able to live seizure-free by taking medication on schedule. For the remainder, there are many resources for coping with uncontrolled seizures. A specialist can help create strategies for reducing the impact seizures have on your life. The American Academy of Neurology and the Epilepsy Foundation provide listings of neurologists who specialize in epilepsy.