Neonatal Seizures

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Definition

- A seizure is a transient occurrence of signs or symptoms resulting from abnorma excessive or synchronous neuronal activity in the brain

- Nonepileptic paroxysmal events are often normal or benign phenomena, although some are clinically significant and consequential.

- Epilepsy is defined as recurrent, *unprovoked seizures*

Etiology

- Seizures during the neonatal period may be the result of multiple causes, with characteristic historical and clinical manifestations.
- Seizures caused by hypoxic-ischemic encephalopathy (postasphyxial seizures), a common cause of seizures in the full-term infant, usually occur 12-24 hours after a history of birth asphyxia and often are refractory to conventional doses of anticonvulsant medications.

- Postasphyxial seizures also may be caused by metabolic disorders associated with neonatal asphyxia, such as hypoglycemia and hypocalcemia.
- Intraventricular hemorrhage (IVH) is a common cause of seizures in premature infants and often occurs between 1 and 3 days of age.
- Seizures with IVH are associated with a bulging fontanelle, hemorrhagic spinal fluid, anemia, lethargy, and coma.
- Seizures caused by hypoglycemia often occur when blood glucose levels decline to the lowest postnatal value (at 1-2 hours of age or after 24-48 hours of poor nutritional intake).
- Seizures caused by hypocalcemia and hypomagnesemia develop in high-risk infants and respond well to therapy with calcium, magnesium, or both.

- Seizures noted in the delivery room often are caused by :
- 1-direct *injection of local anesthetic agents into the fetal scalp (associated with transient bradycardia* and fixed dilated pupils)

2- severe *anoxia*

3-congenital brain malformation

- Seizures after the first 5 days of life may be the result of *infection* or *drug withdrawal*.
- *Seizures associated with lethargy, acidosis, and a family history of* infant deaths may be the result of an *inborn error of metabolism*.

- An infant whose parent has a history of a neonatal seizure also is at risk for *benign familial seizures.*

- *In an infant who appears well, a sudden onset on day 1-3 of life of* seizures that are of short duration and that do not recur may be the result of a *subarachnoid hemorrhage*.

- *Focal seizures often are the result of local cerebral* infarction.

- Seizures may be difficult to differentiate from benign jitteriness or from tremulousness in infants of diabetic mothers, in infants with narcotic withdrawal syndrome, and in any infants after an episode of asphyxia.
- In contrast to seizures, jitteriness and tremors are sensory dependent, elicited by stimuli, and interrupted by holding the extremity.
- Seizure activity becomes manifested as coarse, fast and slow clonic activity, whereas jitteriness is characterized by fine, rapid movement.
- Seizures may be associated with abnormal eye movements, such as tonic deviation to one side.

- The electroencephalogram often shows seizure activity when the clinical diagnosis is uncertain.
- Identifying seizures in the newborn period is often difficult because the infant, especially the low birth weight infant, usually does not show the tonic-clonic major motor activity typical of the older child
- Subtle seizures are a common manifestation in newborns.
- The subtle signs of seizure activity include apnea, eye deviation, tongue thrusting, eye blinking, fluctuation of vital signs, and staring.
- Continuous bedside electroencephalographic monitoring can help identify subtle seizures.

Clinical Characteristics of Neonatal Seizures

DESIGNATION	CHARACTERIZATION
Focal clonic	Repetitive, rhythmic contractions of muscle groups of the limbs, face, or trunk May be unilateral or multifocal May appear synchronously or asynchronously in various body regions Cannot be suppressed by restraint
Focal tonic	Sustained posturing of single limbs Sustained asymmetrical posturing of the trunk Sustained eye deviation Cannot be provoked by stimulation or suppressed by restraint
Myoclonic	Arrhythmic contractions of muscle groups of the limbs, face, or trunk Typically not repetitive or may recur at a slow rate May be generalized, focal, or fragmentary May be provoked by stimulation
Generalized tonic	Sustained symmetrical posturing of limbs, trunk, and neck May be flexor, extensor, or mixed extensor/flexor May be provoked by stimulation May be suppressed by restraint or repositioning

Clinical Characteristics of Neonatal Seizures

Ocular signs	Random and roving eye movements or nystagmus Distinct from tonic eye deviation
Orobuccoling ual movements	Sucking, chewing, tongue protrusions May be provoked by stimulation
Progression movements	Rowing or swimming movements of the arms Pedaling or bicycling movements of the legs May be provoked by stimulation May be suppressed by restraint or repositioning

Diagnostic evaluation

- The diagnostic evaluation of infants with seizures should involve an immediate determination of capillary blood glucose levels with a Chemstrip.
- In addition, blood concentrations of sodium, calcium, glucose, and bilirubin shouldbe determined.
- When infection is suspected, cerebrospinal fluid and blood specimens should be obtained for culture.
- After the seizure has stopped, a careful examination should be done to identify signs of increased intracranial pressure, congenital malformations, and systemic illness.
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- If signs of elevated intracranial pressure are absent, a lumbar puncture should be performed.
- If the diagnosis is not apparent at this point, further evaluation should involve magnetic resonance imaging, computed tomography, or cerebral ultrasound and tests to determine the presence of an inborn error of metabolism.
- Determinations of inborn errors of metabolism are especially important in infants with unexplained lethargy, coma,acidosis, ketonuria, or respiratory alkalosis.

Treatment of Neonatal Seizures

Within 5 minutes:

- baby in thermoneutral environment and ensure airway, breathing and circulation.

- O2 should be started, IV access should be secured, and blood should be collected for sugar and other investigations.
- A brief relevant history should be obtained and quick clinical examination should be performed. All this should not require more than 2-5 minutes.

- If hypoglycemia or if there is no facility to test blood sugar immediately, 4 ml/kg of 10% dextrose should be given as a bolus injection followed by a continuous infusion of 6-8 mg/kg/min.

Treatment of Neonatal Seizures

Calcium gluconate, 10% solution: 2 mL/kg, IV

Magnesium sulfate, 50% solution: 0.2 mL/kg, IM

Pyridoxine: 50-100 mg, IV; repeat to maximum of 500 mg if needed

Treatment

- In the absence of an identifiable cause, therapy should involve an anticonvulsant agent, such as:

- 20-40 mg/kg of phenobarbital
- -10-20 mg/kg of phenytoin
- - or 0.1- 0.3 mg/kg of diazepam.

Drug Therapy For Neonatal Seizures

Standard Therapy

AED	Initial Dose	Maintenance Dose	Route
Phenobarbital	20mg/kg	3 to 4 mg/kg per day	IV, IM, PO
Phenytoin	20 mg/kg	3 to 4 mg/kg per day	IV, PO[a]
Fosphenytoin	20 mg/kg phenytoin equivalents	3 to 4 mg/kg per day	IV, IM
Lorazepam[2]	0.05 to 0.1 mg/kg	Every 8 to 12 hours	IV
Diazepam[2,]	0.25 mg/kg	Every 6 to 8 hours	IV

AED= andtiepileptic drug; IV= intravenous; IM= intramuscular; PO= oral

[a]Oral phenytoin is not well absorbed.

[2]Benzodiazepines typically not used for maintenance therapy.

[3]Lorazepam preferred over diazepam.

- Treatment of status epilepticus requires repeated doses of phenobarbital and may require diazepam or midazolam, titrated to clinical signs.

Determinants of Duration of anticonvulsant therapy for neonatal seizures

- Neonatal neurological examination
- Cause of neonatal seizure
- Electroencephalogram

outcome

- The long-term outcome for neonatal seizures usually is related to the underlying cause and to the primary pathology, such as hypoxic-ischemic encephalopathy, meningitis, drug withdrawal, stroke, or hemorrhage.

Prognosis

Two most useful approaches in utilizing outcome

- EEG
- Recognition of the underlying neurological disease

Prognosis of Neonatal seizures in relation to EEG

EEG BACKGROUND	NEUROLOGICAL SEQUELAE(%)
Normal	≤10
Severe abnormalities†	≥90
Moderate abnormalities‡	**~50**

Based primarily on data reported by Rowe JC, Holmes GL, Hafford J, et al: Electroencephalogr Clin Neurophysiol 60:183-196, 1985; Lombroso CT: In Wasterlain CG, Treeman DM, Porter R, editors: Advances in neurology, New York, 1983, Raven Press; and includes both full-term and premature infants.

†Burst-suppression pattern, marked voltage suppression, and electrocerebral Silence.

‡Voltage asymmetries and "immaturity."

Complications

- Cerebral palsy
- Hydrocephalus
- Epilepsy
- Spasticity
- Feeding difficulties

Consultations

- Neurology consult needed for
  - evaluation of seizures
  - evaluation of EEG and video EEG monitoring
  - management of anticonvulsant medications

Further Outpatient Care

- Neurology outpatient evaluation
- Developmental evaluation for early identification of physical or cognitive deficits
- Orthopedic evaluations if with joint deformities
- Consider physical medicine/physical therapy referral if indicated

Summary

- Seizures in the newborn period constitute a medical emergency.
- Subtle seizures are the commonest type of seizures occurring in the neonatal period.
- Other types include clonic, tonic, and myoclonic seizures.
- Myoclonic seizures carry the worst prognosis in terms of long-term neurodevelopmental outcome.
- Hypoxic-ischemic encephalopathy is the most common cause of neonatal seizures.
- Multiple etiologies often co-exist in neonates and hence it is essential to rule out common causes such as hypoglycemia ,hypocalcemia , meningitis before initiating specific therapy.

THANY YOU