Neonatal Seizures

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Clinical feature

- Neonatal seizures or neonatal convulsions are epileptic fits occurring from birth to the end of the neonatal period. 1–18 The neonatal period is the most vulnerable of all periods of life for developing seizures, particularly in the first 1–2 days to the first week from birth. They may be short-lived events lasting for a few days only. However, they often signify serious malfunction of or damage to the immature brain and constitute a neurological emergency demanding urgent diagnosis and management.

Demographic data

- The prevalence is approximately 1.5% and overall incidence approximately 3 per 1000 live births. The incidence in pre-term infants is very high (57–132 per 1000 live births). Most (80%) neonatal seizures occur in the first 1–2 days to the first week of life.

Clinical Manifstation

- Neonatal seizures, as with any other type of seizure, are paroxysmal, repetitive and stereotypical events. They are usually clinically subtle, inconspicuous and difficult to recognise from the normal behaviours of the inter-ictal periods or physiological phenomena. There is no recognisable post-ictal state. Generalised tonic clonic seizures (GTCS) are exceptional. The most widely used scheme is by Volpe20 of five main types of neonatal seizure.

- Subtle seizures (50%)
- Tonic seizures (5%)
- Clonic seizures (25%)
- Myoclonic seizures (20%)
- Non-paroxysmal repititve behavior

Useful Defintions

Useful Defintions

- The neonatal period is defined as the first 28 days of life of a full-term infant.
- Neonatal seizures are those that occur from birth to the end of the neonatal period.
- Gestational age is defined as the duration of pregnancy.
- Chronological age is the actual legal age of the infant from the time of birth.
- Conceptional age is the combined gestational and chronological ages.
- Full-term infants are those of 40 weeks gestational age.

classfication

- neonatal seizures are classified as follows: focal clonic, focal tonic, generalised tonic, myoclonic, spasms and motor automatisms (which include occular signs, oral–buccal–lingual movements, progression movements and complex purposeless movements).

Subtle Seizures

- Subtle seizures are far more common than other types of neonatal seizures. They are described as subtle because the clinical manifestations are frequently overlooked. They imitate normal behaviours and reactions. These include the following.

- Ocular movements, which range from random and roving eye movements to sustained conjugate tonic deviation with or without jerking. Eyelid blinking or fluttering, eyes rolling up, eye opening, fixation of a gaze or nystagmus may occur alone or with other ictal manifestations.
- Oral–buccal–lingual movements (sucking, smacking, chewing and tongue protrusions).
- Progression movements (rowing, swimming, pedalling, bicycling, thrashing or struggling movements).
- Complex purposeless movements (sudden arousal with episodic limb hyperactivity and crying).

Motor Seizures

- Clonic seizures are rhythmic jerks that may localise in a small part of the face or limbs, axial muscles and the diaphragm or be multifocal or hemiconvulsive. Todd's paresis follows prolonged hemiconvulsions.

- Tonic seizures manifest with sustained contraction of facial, limb, axial and other muscles. They may be focal, multifocal or generalised, symmetrical or asymmetrical. Truncal or limb tonic extension imitates decerebrate or decorticate posturing.

- Myoclonic seizures are rapid, single or arrhythmic repetitive jerks. They may affect a finger, a limb or the whole body. They may mimic the Moro reflex and startling responses. They are more frequent in pre-term than full-term infants indicating, if massive, major brain injury and poor prognosis. Myoclonic seizures are associated with the most severe brain damage. However, healthy pre-term and rarely full-term neonates may have abundant myoclonic movements during sleep. Neonates have cortical, reticular and segmental types of myoclonus, similar to adult forms.

- Spasms producing flexion or extension similar to those of West syndrome are rare. They are slower than myoclonic seizures and faster than tonic seizures.

Duration of neonatal seizures

- The duration of neonatal seizures is usually brief (10 s to 1–2 min) and repetitive with a median of 8 min in between each seizure. Longer seizures and status epilepticus develop more readily at this age, but convulsive neonatal status epilepticus is not as severe as that of older infants and children.

Aetiology

- Aetiology of neonatal seizures is extensive and diverse . Severe causes predominate. The prevalence and significance of aetiological factors are continuously changing and differ between developed and developing countries depending on available improved neonatal and obstetric care.

- By far the commonest cause is hypoxic–ischaemic encephalopathy. It may be responsible for 80% of all seizures in the first 2 days of life.28 Brain damage due to prenatal distress and malformations of cortical development is being increasingly recognised. Intracranial haemorrhage and infarction, stroke and prenatal and neonatal infections are common. Most previously common acute metabolic disturbances such as electrolyte and glucose abnormalities have been minimised because of improved neonatal intensive care and awareness of nutritional hazards. Late hypocalcaemia is virtually eliminated, while electrolytic derangement and hypoglycaemia are now rare.

- Inborn errors of metabolism such as urea cycle disorders are rare.

- Pyridoxine dependency, with seizures in the first days of life (which are reversible with treatment), is exceptional.

- Exogenous causes of neonatal convulsions may be iatrogenic or due to drug withdrawal in babies born to mothers on drugs.

- In most cases, the neonate may present with a combination of different neurological disturbances, each of which can cause seizures

Diagnostic Procedures

- Neonatal seizures represent one of the very few emergencies in the newborn. Abnormal, repetitive and stereotypic behaviours of neonates should be suspected and evaluated as possible seizures. Polygraphic video–EEG recording of suspected events is probably mandatory for an incontrovertible seizure diagnosis. Confirmation of neonatal seizures should initiate urgent and appropriate clinical and laboratory evaluation for the aetiological cause and treatment. Family and prenatal history is important. A thorough physical examination of the neonate should be coupled with urgent and comprehensive biochemical tests for correctable metabolic disturbances. Although rare, more severe inborn errors of metabolism should be considered for diagnosis and treatment

Brain Imaging

- Cranial ultrasonography, brain imaging with X-ray computed tomography (CT) scan and preferably magnetic resonance imaging (MRI)37 should be used for the detection of structural abnormalities such as malformations of cortical development, intracranial haemorrhage, hydrocephalus and cerebral infarction.

Electroencephalography

- The neonatal EEG is probably one of the best and most useful of EEG applications. However, neonatal EEG recordings and interpretations require the special skills of well-trained technologists and physicians. Polygraphic studies with simultaneous video–EEG recording are essential.

Management

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- This demands accurate aetiological diagnosis and treatment of the cause of the seizures. The principles of general medical management and cardiovascular and respiratory stabilisation should be early and appropriately applied. Cardiorespiratory symptoms may result from the underlying disease, the seizures and the anti-epileptic medication.

- Neonatal seizures of metabolic disturbances need correction of the underlying cause and not anti-epileptic medication. A trial of pyridoxine may be justifiable.

- The drug treatment of neonatal seizures is empirical with significant practice variations amongst physicians. Phenobarbitone first and then phenytoin are the most commonly used AEDs, although short-acting benzodiazepines are gaining ground. Large loading doses are followed by a maintenance scheme for a variable period.

Phenobarbitone and Phenytoin

- Phenobarbitone and phenytoin are equally but incompletely effective as anticonvulsants in neonates. Phenobarbitone in a loading dose of 15–20 mg/kg and a maintenance dose of 3–4 mg/kg daily controls one-third of neonatal seizures. Efficacy may improve to 85% with stepwise increments to 40 mg/kg. The serum levels required are between 16 and 40 µg/ml. Phenytoin may be equally as effective as phenobarbitone at a loading dose of 15–20 mg/kg. With either drug given alone, the seizures are controlled in fewer than half of the neonates. The severity of the seizures appears to be a stronger predictor of the success of treatment than the assigned AED. Mild seizures or seizures decreasing in severity before treatment are more likely to respond regardless of the treatment assignment

- Intravenous benzodiazepines such as diazepam, lorazepam, clonazepam and midazolam are used particularly in Europe for acute neonatal seizures. They may be used as the first anti-seizure AED. However, in a recent randomised trial of second-line anticonvulsant treatments for neonates 11 out of 22 subjects responded to phenobarbitone at a dose of 40 mg/kg as first-line treatment. Three of five neonates treated with lignocaine responded. However, neonates treated with benzodiazepines as second-line treatment, none responded and their neurodevelopmental outcome was poor.