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PAEDIATRICS NEUROLOGY

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Seizure

A seizure (fit) is a paroxysmal change in motor, sensory, autonomic activity, and/or behavior, resulting from abnormal neuronal activity in the brain. Convulsion is motor seizure, so the fit may be convulsive or not convulsive.

Seizures are common in the pediatric age group.

Etiology:

1- **Acute symptomatic seizure**: occur secondary to an acute problem affecting brain excitability:

A- Metabolic: hypoglycemia, hypocalcaemia, hypomagnesaemia, hypo- & hypernatremia, inborn error of metabolism.

B- Febrile convulsion.

C- Infection: meningitis, encephalitis, acute stroke, or brain tumor, shigellosis

D- Hypoxia, toxins.

E- cardiac arrhythmias.

2- **Remote symptomatic seizure** is one that is considered to be secondary to a distant brain injury, such as an old stroke.

3- **Epilepsy**.

Less than one third of seizures in children are caused by epilepsy. it is a condition in which seizures are triggered recurrently from within the brain cells, epilepsy is considered to be present when two or more unprovoked seizures occur at an interval greater than 24 hr apart, or single unprovoked seizure with EEG findings. It can be idiopathic (genetic), symptomatic, or unknown epilepsy.

- **Unprovoked seizure** term is a seizure that is not acute symptomatic seizure**.**
- Most seizures in children are provoked by somatic disorders originating outside the brain cells:
- Approximately 4-10% of children experience at least 1 seizure in the 1st 16 yr of life. The cumulative lifetime incidence of epilepsy is 3%, and more than half of the cases start in childhood. The annual prevalence of epilepsy is 0.5-1.0%.

CLASSIFICATION OF SEIZURES

It is important to classify the type of seizure. It may provide a clue to the cause of the seizure disorder, choosing the most appropriate treatment, & making a prognosis.

Clinical classification of seizures may be difficult because the manifestations of different seizure types may be similar; EEG is a useful adjunct to the clinical classification.

1- FOCAL (PARTIAL) SEIZURES: initial activation of a system of neurons limited to part of 1 cerebral hemisphere**.**

a- Simple partial (consciousness retained)
- Motor: tonic–clonic, tonic, clonic, myoclonic, or atonic
- Sensory
- Autonomic
- Psychic

b- Complex partial (consciousness impaired): focal dyscognitive, denote focal seizures with altered awareness of the surroundings.

c- Partial seizures with secondary generalization.

2- GENERALIZED SEIZURES: synchronous involvement of all of both hemispheres, it may be tonic–clonic, tonic, clonic, myoclonic, or atonic

3- UNCLASSIFIED SEIZURES
- Febrile convulsions
- Absence
- Infantile spasms
- Lennox-Gastaut syndrome
- Other syndromes

IMPORTANT DEFINITIONS

- Tonic: rigid posturing
- Clonic: rhythmic fast muscle contractions and slightly longer relaxations.
- Myoclonic: is a "shock-like" contraction of a muscle of <50 msec that is often repeated, but not in rhythmic pattern.
- Atonic: sudden flaccidity or lack of movement during a convulsion
- Aura: abnormal feeling e.g. chest discomfort, headache, vague, unpleasant feelings, epigastric discomfort, or fear. It is always indicates a focal onset of the seizure.
- Automatism: abnormal behavior; alimentary automatisms or motor automatism.

Alimentary automatisms, usually in infants, including lip smacking, chewing, swallowing, and excessive salivation. Motor Automatism, in older children, consists of semi-purposeful & uncoordinated movement, including picking and pulling at clothing or bed sheets, rubbing objects, and walking or running in a nondirective, repetitive, and often fearful fashion.

- Postictal: symptomatic period immediately after seizure.

GENERALIZED TONIC-CLONIC SEIZURES

These seizures are extremely common; they may be associated with an aura, suggesting a focal origin of the epileptic discharge.

Patients suddenly lose consciousness and, in some cases, emit a shrill cry. Their eyes roll back, their entire body musculature undergoes tonic contractions, and they rapidly become cyanotic in association with apnea, then the clonic phase started with rhythmic clonic contractions. The clonic phase slows toward the end of the seizure. Postictally, children are initially semi comatose and typically remain in a deep sleep from 30 min to 2 hr. If patients are examined during the seizure or immediately postictally, they may demonstrate truncal ataxia, hyperactive deep tendon reflexes, clonus, and a Babinski reflex.

During the seizure, children may bite their tongue but rarely vomit. Loss of sphincter control, particularly the bladder, is common. The postictal phase is often associated with vomiting and an intense bifrontal headache.

Tight clothing and jewelry around the neck should be loosened, the patient should be placed on one side, and the neck and jaw should be gently hyperextended to enhance breathing. The mouth should not be opened forcibly by an object or by a finger because the patient's teeth may be dislodged and aspirated, or significant injury to the oropharyngeal cavity may result.

Idiopathic seizure is a term applied when the cause of a generalized seizure cannot be ascertained. Many factors are known to precipitate generalized tonic-clonic seizures in children, including low-grade fever associated with infections, excessive fatigue or emotional stress, and various drugs including psychotropic medications, theophylline, and methylphenidate, particularly if the seizures are poorly controlled by anticonvulsant drugs.

SIMPLE PARTIAL SEIZURES (SPS)

Motor type is the most common. The movements are characterized by unilateral abnormal movements for 10- 20 sec, it involve the face, neck, and extremities with no postictal phase. The patients **remain conscious** and may verbalize during the seizure. It may be confused with tics which can be briefly suppressed, but partial seizures cannot be controlled.

- The **EEG** may show spikes or sharp waves.

COMPLEX PARTIAL SEIZURES (CPS)

- It characterized by impaired consciousness as a brief blank stare or a sudden cessation or pause in activity that is frequently overlooked by the parent.
- An **aura** is present in 1/3 of patients.
- **Automatisms** are a common feature of CPS in infants and children.
- Spreading of the epileptiform discharge during CPS can result in tonic-clonic convulsion.
- The average duration of a CPS is 1–2 min, which is considerably longer than an SPS or an absence seizure.
- **EEG**: Temporal lobe sharp waves or focal spikes.
- CT scanning & MRI: identify an abnormality in the temporal lobe.

ABSENCE SEIZURES

Simple absence (petit mal) seizures are characterized by a sudden cessation of motor activity or speech with a blank facial expression and flickering of the eyelids.

- Uncommon before age 5 yr, more prevalent in girls.
- Rarely persist longer than 30 sec.
- Children with absence seizures may experience countless seizures daily, whereas complex partial seizures are usually less frequent.
- Important cause for decrease school performance.
- The EEG shows a typical 3 spikes /sec and generalized wave discharge.
- Hyperventilation for 3–4 min routinely produces an absence seizure.

INFANTILE SPASMS (SALAAM ATTACK)

Brief symmetric contractions of the neck, trunk, and extremities. It usually begins between the ages of 4 and 8 mo, these movement may be flexor, extensor, and mixed. These occur in clusters mostly appear at sleep or arousal, they may persist for minutes, with brief intervals between each spasm. A cry may precede or follow an infantile spasm, accounting for the confusion with colic in a few cases.

The EEG findings: called hypsarrhythmia, which consists of a chaotic pattern of high-voltage, bilaterally asynchronous, slow-wave activity.

Infantile spasms are typically classified into two groups: **cryptogenic** (10–20%) and **symptomatic.** Symptomatic infantile spasms are related directly to several prenatal, perinatal, and postnatal factors.

Infants with cryptogenic infantile spasms have a good prognosis, whereas those with the symptomatic type have an 80–90% risk of mental retardation.

A hypothesis proposed that specified stresses or injury to an infant during a critical period of neurodevelopment causes CRH (act as neurotransmitter) overproduction, resulting in neuronal hyperexcitability and seizures. Exogenous ACTH and glucocorticoids suppress CRH synthesis, which may account for their effectiveness in treating infantile spasms.

Treatment of choice: ACTH, prednisolone, vigabatrin.

FEBRILE SEIZURES

It is the most common seizure disorder during childhood (3–4%), they are seizures that occur between the age of 6 and 60 mo with a temperature of 38°C or higher, that are not the result of central nervous system infection or any metabolic imbalance, and occur in the absence of a history of prior afebrile seizures. A strong family history of febrile convulsions in siblings and parents suggests a genetic predisposition. An autosomal dominant inheritance **pattern is demonstrated in some families.**

Types

A **simple febrile seizure** is a primary generalized, usually tonic–clonic, lasting for a maximum of 15 min, and not recurrent within a 24-hr period. A **complex febrile seizure** is either prolonged (>15 min), focal, and/or reoccurs within 24 hr.

Diagnosis

During the acute evaluation, a physician's most important responsibility is to determine the cause of the fever and to rule out meningitis or encephalitis. Viral infections of the upper respiratory tract, Roseola infantum, acute otitis media, HHV infection, and shigellosis are most frequently the causes of febrile convulsions.

If any doubt exists about the possibility of meningitis, a lumbar puncture with examination of the cerebrospinal fluid (CSF) is indicated, it should be performed :

1- for all infants younger than 6 mo of age who present with fever and seizure.

2- if the child is ill appearing or has signs of meningial irritation.

3- A lumbar puncture is an option in a child 6-12 mo of age who is deficient in H. influenzae type b and S. pneumonia immunizations or for whom immunization status is unknown, and in children who have been pretreated with antibiotics.

Blood glucose should be determined in children with prolonged post-ictal obtundation or with poor oral intake (prolonged fasting). Other laboratory tests such as serum electrolytes and toxicology screening should be ordered based on individual clinical circumstances such as evidence of dehydration.

EEG need not to be performed as part of the evaluation for the first simple febrile seizure in neurologically healthy child; therefore EEG should be restricted to special cases in which epilepsy is highly suspected. If it is indicated, it should be delayed until or repeated after more than 2 wk have passed.

A CT or MRI is not recommended in evaluating the child after a first simple febrile seizure. The work-up of children with complex febrile seizures needs to be individualized.

Treatment

Family role: Reassurance and education of the parents on how to handle a seizure acutely and if the seizure lasts for longer than 5 min, rectal diazepam is often prescribed to be given, alternatively, buccal or intranasal midazolam may be used and is often preferred by parents. If the parents are very anxious concerning their child's seizures, intermittent oral diazepam (0.33 mg/kg every 8 hr) is given during fever, the side effects of diazepam are usually minor, but symptoms of lethargy, irritability, and ataxia may be reduced by adjusting the dose.

Antipyretics can decrease the discomfort of the child and are reassuring but do not reduce the risk of having a recurrent febrile seizure, probably because the seizure often occurs as the temperature is rising or falling.

Chronic antiepileptic therapy: *In the vast majority of cases, it is not justified to use continuous therapy owing to the risk of side effects and lack of demonstrated long-term benefits, even if the recurrence rate of febrile seizures is expected to be decreased by these drugs.* Chronic antiepileptic therapy may be considered for children with a high risk for later epilepsy, but currently available data indicate that the possibility of future epilepsy does not change with or without antiepileptic therapy.

Others: Iron deficiency is associated with an increased risk of febrile seizures, and thus screening for that problem and treating it appears appropriate.

Prognosis: It generally has an excellent prognosis but may also signify a serious underlying acute infectious disease such as sepsis or bacterial meningitis. Therefore, each child with a seizure associated with fever must be carefully examined and appropriately investigated for the cause of the fever, especially when it is the 1st seizure.

Compared with age-matched controls, patients with febrile seizures do not have any increase in the incidence of abnormalities of behavior, scholastic performance, neurocognitive function, or attention. only 2-7% of children who experience febrile seizures proceed to develop epilepsy later in life.