Childhood Epilepsy: An Overview

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Abstract

Childhood epilepsy is a neurologic disorder characterized by a transient manifestation of signs and symptoms resulting from abnormal, excessive, or synchronized neuronal activity in the brain, affecting a significant number of children globally. This abstract provides an overview of key aspects related to childhood epilepsy, encompassing its epidemiology, pathophysiology, clinical manifestations, diagnostic modalities, and management considerations. Diagnostic tools, including electroencephalography (EEG) and neuroimaging, play crucial roles in confirming the diagnosis, identifying potential causes, and guiding treatment decisions. Beyond seizures, childhood epilepsy often presents with impacting cognitive function, psychosocial conditions, and physical issues. Early and accurate diagnosis, coupled with a multidisciplinary approach to care, is essential for optimizing outcomes and providing holistic support to children with epilepsy and their families. This overview research aims to deepen our understanding of the diverse facets of childhood epilepsy, paving the way for improved therapeutic interventions and enhanced long-term prognosis.

Keywords: Childhood Epilepsy, Diagnosis, Treatment

1. Introduction

Epilepsy, also known as a seizure disorder, stands as the predominant neurological condition among children in the United States. Epilepsy stands as the most prevalent neurological brain disorder observed in the pediatric population. Approximately 3 million Americans grapple with epilepsy, with a subset of 450,000 individuals aged under 17. This condition manifests through recurrent seizures, marked by abrupt spikes in electrical activity within the brain (American Academy of Pediatrics, 2020). The highest incidence of epilepsy, reaching 102 per 100,000 cases annually, occurs predominantly within the initial year of life, extending through the age range of 1 to 12 years. Among children aged 11–17, the incidence of epilepsy ranges from 21 to 24 per 100,000 cases (Giussani et al., 2014; Lv et al., 2017)

Patients with epilepsy still suffer both physically and mentally, because this disease interference in daily functioning (World Health Organization, 2023). Early diagnosis is essential for minimizing the risk of recurrence, improving prognosis, and optimizing treatment. Moreover, the early diagnosis of epilepsy in childhood significantly influences the psychological and physical development of the child (Rozensztrauch and Kołtuniuk, 2022). Diagnosing epilepsy can present challenges, given the need to consider various conditions that mimic its symptoms. Neuroimaging and electroencephalography are deemed crucial in elucidating the condition's etiology (Fine and Wirrell, 2020).

2. Childhood Epilepsy

2.1. Definition

Seizures are characterized by a transient manifestation of signs and symptoms resulting from abnormal, excessive, or synchronized neuronal activity in the brain. This is marked by sudden and involuntary skeletal muscle activity (Minardi et al., 2019). Epilepsy is a neurological condition marked by a persistent susceptibility to initiate epileptic seizures, along with the neurobiological, cognitive, psychological, and social repercussions stemming from this state (Fisher et al., 2005). The task force recommended conceptualizing epilepsy as a neurological disorder delineated by any of the subsequent criteria: (Fisher et al., 2014)
(1) Occurrence of at least two unprovoked (or reflex) seizures with an interval of more than 24 hours between them;
(2) manifestation of a single unprovoked (or reflex) seizure along with a likelihood of subsequent seizures comparable to the general recurrence risk (at least 60%) following two unprovoked seizures, anticipated over the subsequent 10 years;
(3) confirmation of an epilepsy syndrome through diagnosis.

Neonatal or childhood epilepsy is a condition characterized by the occurrence of seizures during the most susceptible period, the neonatal phase. (Kang and Kadam, 2015). Approximately 75% of epilepsy begins during childhood, reflecting the heightened susceptibility of the developing brain, the child's immature CNS, to seizures (Stafstrom and Carmant, 2015).

2.2. Classification of Childhood Epilepsy by ILAE

2.2.1. Self-limited Epilepsies

2.2.1.1. Self-limited (Familial) Neonatal Epilepsy (SeLNE)

Self-limited neonatal epilepsy (SeLNE) and self-limited familial neonatal epilepsy share similar clinical and electrographic characteristics but can be differentiated based on familial history. Autosomal dominant inheritance patterns are observable within families, occasionally with incomplete penetrance. SeLNE may result from de novo pathogenic variants in the same genes, KCNQ2 and KCNQ3, implicated in self-limited familial neonatal epilepsy. The onset of seizures typically occurs between days 2 and 7 of life, often presenting with focal tonic or focal clonic features or progressing to sequential features. Focal seizures may alternate sides between episodes, and the recurrence of seizures can transpire over hours to days. Generally, developmental milestones remain within the normal range (Zuberi et al., 2022).

2.2.1.2. Self-limited Familial Neonatal-infantile Epilepsy

SeLFNIE is a syndrome characterized by autosomal dominant inheritance with onset during the neonatal or infantile period among different family members. This condition has been identified in families and is attributed to dominantly inherited SCN2A pathogenic variants, with rare cases associated with KCNQ2 pathogenic variants in certain families. Nonfamilial cases are likely to result from de novo pathogenic gene variants. Distinguishing this syndrome from SeLNE or SeLIE is possible through a family history that documents the onset of self-limited epilepsy in some members during the neonatal period and others during the infantile period. Seizures typically commence between day 2 and 7 months of life, manifesting with a semiology akin to self-limited neonatal epilepsy, featuring focal clonic or focal tonic elements with vary in

duration from 20 s to 4 min, often occurring in clusters. Seizures may recur over hours to days, and developmental milestones are generally within the normal range (Zuberi et al., 2022).

2.2.1.3. Self-limited Infantile Epilepsy (SeLIE)

SeLIE, formerly recognized as benign familial (and nonfamilial) infantile seizures, is a syndrome characterized by the onset of seizures during the infantile period, typically occurring between 3 to 20 months, with a peak around 6 months. Seizures are often frequent and may pose challenges in control at the onset but tend to spontaneously resolve within one year from the onset. Children experiencing SeLIE generally exhibit normal developmental progress. Initially identified in families displaying a dominant inheritance pattern of infantile seizures, the syndrome later encompassed the familial syndrome of Infantile Convulsions Choreo-Athetosis, featuring a movement disorder of paroxysmal kinesigenic dyskinesia/dystonia. In this broader context, affected family members may exhibit seizures, a movement disorder, or both. Clinically, de novo and familial SeLIE are indistinguishable, except for the presence of a family history in the latter. The most prevalent genetic etiology for SeLIE involves pathogenic variants in PRRT2. Familial cases demonstrate autosomal dominant inheritance with incomplete penetrance (Zuberi et al., 2022).

2.2.1.4. Genetic Epilepsy with Febrile Seizures Plus (GEFS+)

GEFS+ was initially characterized as an autosomal dominant familial epilepsy with variable penetrance. This condition encompasses a range of epilepsy phenotypes, including epilepsy with myoclonic atonic seizures, Dravet syndrome (DS), idiopathic and other genetic generalized epilepsy syndromes, and focal epilepsies, all displaying diverse phenotypes typically present within the same family. While febrile seizures are a defining feature of GEFS+ and occur in many affected family members, not all individuals with GEFS+ and febrile seizures exhibit this symptom. GEFS+ exhibits heterogeneous genetic etiologies, involving pathogenic variants in various identified genes (Zuberi et al., 2022).

The most prevalent phenotype in GEFS+ is classical febrile seizures, and the subsequent common phenotype is Febrile Seizures plus (FS+). Children with FS+ may manifest different presentations, with the most frequent being the continuation of typical febrile seizures beyond the age of 6 years, the typical age at which most febrile seizures cease. In infancy, a robust family history of GEFS+ phenotypes suggests this diagnosis. However, recent cases with FS+ phenotypes have emerged without a family history, featuring a de novo pathogenic variant in a GEFS+ gene (Zuberi et al., 2022).

2.2.1.5. Myoclonic Epilepsy in Infancy (MEI)

This syndrome manifests with myoclonic seizures at the onset, which may be triggered by sudden noise, startle, or touch, and less commonly by photic stimulation. Some authors suggest using the term "Reflex Myoclonic Epilepsy in Infancy" when myoclonic seizures are activated by triggering factors like sudden noise or startle. The syndrome begins between the ages of 4 months and 3 years, with a peak age of 6–18 months. They propose that children with this syndrome experience a slightly earlier age at onset, a better response to antiseizure medication, a higher remission rate, and a more favorable cognitive outcome. However, this syndrome could be regarded as a subgroup of MEI. Seizures are self-limiting in most cases. An EEG, preferably with video and electromyography (EMG), is essential to confirm the epileptic nature of the myoclonus and to rule out Infantile Epileptic Spasms Syndrome (IESS), which is much more common and severe than MEI (Zuberi et al., 2022).

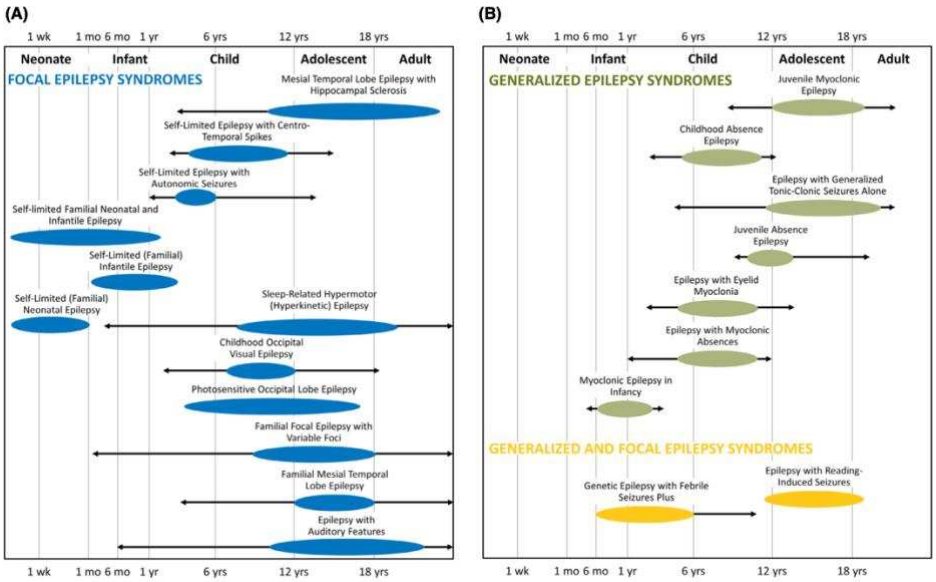

Fig. 1. (A) Age of presentation of focal epilepsy syndromes; (B) Age of presentation of generalized epilepsy syndromes (Wirrell et al., 2022)

2.2.2. Developmental and Epileptic Encephalopathies (DEE)

2.2.2.1. Early Infantile Developmental and Epileptic Encephalopathy (EIDEE)

EIDEE is a syndrome characterized by: (Zuberi et al., 2022).

- Onset of epilepsy within the first 3 months of life with frequent seizures that are typically resistant to drugs.
- Abnormal neurological examination findings, such as abnormalities of posture, tone, or movement.
- Moderate to profound developmental impairment evident over time.
- Abnormal inter-ictal EEG, which may exhibit a burst-suppression pattern, diffuse slowing, or multi-focal discharges.
- Neuroimaging, metabolic, and genetic testing allows precise etiological classification in approximately 80% of cases.

Predominant seizure types include focal tonic, generalized tonic, myoclonic, focal clonic, and epileptic spasms. Sequential seizures may occur. EIDEE encompasses neonates and infants previously classified as Ohtahara syndrome and Early Myoclonic Encephalopathy. The syndrome may have various underlying etiologies, including genetic, metabolic, and structural factors. The electroclinical descriptions of Ohtahara syndrome (primarily featuring a burst suppression EEG pattern and tonic seizures) and Early Myoclonic Encephalopathy (mainly characterized by myoclonic seizures and either burst-suppression or other significant EEG abnormalities) have been highly valuable in epilepsy classification (Zuberi et al., 2022).

2.2.2.2. Epilepsy in Infancy with Migrating Focal Seizures (EIMFS)

EIMFS is a rare developmental and epileptic encephalopathy characterized by drug-resistant focal seizures that commence within the first year of life, accompanied by severe encephalopathy. Focal seizures may originate in both hemispheres and migrate from one cortical region to another within a seizure episode. These seizures are often prolonged, with instances of status epilepticus. The primary cause is genetic, with KCNT1 being the major gene and over 25 other genes associated with this syndrome. The prognosis is unfavorable, resulting in severe neurological impairment and a reduced life expectancy, potentially influenced by the specific genetic mutation, although a milder course has been documented in a small number of children (Zuberi et al., 2022).

2.2.2.3. Infantile Epileptic Spasms Syndrome (EISS)

IESS is a term proposed to encompass both West syndrome, as well as infants exhibiting epileptic spasms but not meeting all the classic criteria for West syndrome. Traditionally, West syndrome consists of the triad of epileptic spasms, hypsarrhythmia, and developmental stagnation or regression. However, infants with IESS may not manifest all three criteria; for instance, the developmental impact might not be evident, or typical hypsarrhythmia may be absent (Zuberi et al., 2022).

IESS is characterized by the onset of epileptic spasms occurring between 1 and 24 months of age, with the peak typically between 3 and 12 months. Nevertheless, later onset is possible. Infants may lack an antecedent history, or the antecedent history may reveal the underlying cause, such as an acquired structural brain or genetic abnormality. In certain instances, infants initially diagnosed with EIDEE or other early-onset epilepsies (usually featuring focal seizures) may evolve to exhibit clinical and EEG features of IESS after 3–4 months of age. In terms of developmental outcomes, many infants experience a suboptimal developmental trajectory, irrespective of the seizure outcome. The severity of developmental delay is primarily linked to the underlying cause and the timeliness of intervention (Zuberi et al., 2022).

2.2.2.4. Dravel Syndrome (DS)

DS (formerly recognized as Severe Myoclonic Epilepsy of Infancy) manifests in the first year of life in an otherwise healthy child, featuring prolonged, febrile, and afebrile seizures, notably focal clonic (typically hemiclonic) or generalized clonic seizures. Additional seizure types, such as myoclonic and atypical absence seizures, emerge between 1 and 4 years of age. Seizures are typically refractory, and cognitive and behavioral impairments become evident from the second year of life onwards. Gait abnormalities, including a distinctive crouch gait, are commonly observed in late childhood. The clinical diagnosis is corroborated by the detection of pathogenic variants in the sodium channel gene SCN1A (identified in over 80% of cases) (Zuberi et al., 2022).

2.2.3. Etiology-specific Syndromes

2.2.3.1. KCNQ2-DEE

KCNQ2-DEE induces neonatal-onset encephalopathy and arises from de novo missense variants in specific regions (hot spots) of the KCNQ2 gene, resulting in a distinct disorder from self-limited neonatal epilepsy. Focal tonic seizures are the most commonly observed, although other seizure types, including focal clonic and myoclonic seizures, may also manifest. Seizure initiation occurs within the first few days of life amid a severe neonatal encephalopathy marked by abnormal neurological examination and behavior. Seizures may exhibit responsiveness to sodium channel blockers. Although epilepsy frequently undergoes remission,

the developmental outcome typically ranges from moderately to severely impaired. Over half of the patients will achieve seizure freedom, with the onset varying from a few months to several years (Zuberi et al., 2022).

2.2.3.2. Pyridoxine-dependent (ALDHA7A1)-DEE (PD-DEE) and *Pyridox(am)ine 5'*-Phosphate Deficiency (PNPO)-DEE (PSPD-DEE)

PDE-DEE and P5P-DEE are caused by genetic-metabolic defects within the same lysine degradation pathway. Most cases of PD-DEE are associated with biallelic variants in ALDH7A1, also known as antiquitin, with a minority associated with biallelic variants in PLBP (previously known as PROSC). Pyridox(am)ine 5' phosphate deficiency is associated with biallelic variants in the PNPO gene. Seizures may manifest antenatally as excessive fetal movements and typically present in the first hours to days of life. Various types of seizures may manifest, including focal seizures, spasms, and generalized tonic-clonic seizures. The clinical presentation of a hyperkinetic, apparently distressed, and agitated infant displaying multifocal myoclonus and spasms should raise awareness among clinicians regarding the potential presence of PD-DEE or P5PD-DEE. Seizure control can be achieved in almost all cases with pharmacological doses of pyridoxine and pyridoxal-5'-phosphate, respectively, emphasizing the importance of early recognition. Some infants with P5PD-DEE respond partially or completely to pyridoxine therapy (Zuberi et al., 2022).

2.2.3.3. CDKL5-DEE

CDKL5-DEE, also referred to as CDKL5 deficiency disorder, is a developmental and epileptic encephalopathy resulting from pathogenic variants in the cyclin-dependent kinase-like 5 (CDKL5) gene. It stands as a significant cause of epilepsy with a very early onset, typically occurring at a median age of 6 weeks, accompanied by notable hypotonia. While the distinctive combination of infantile spasms and tonic seizures in the initial months of life is a hallmark, various seizure types can manifest. The seizures often exhibit multiple phases, with a classic sequence of hypermotor (hyperkinetic), tonic, and spasms. Almost all cases are characterized by severe to profound global developmental delay (Zuberi et al., 2022).

2.2.3.4. PCDH19 Clustering Epilepsy

PCDH19 Clustering Epilepsy is an X-linked disorder, primarily observed in females, resulting from pathogenic variants in the PCDH19 gene. There are limited reports of affected males. The onset of epilepsy typically occurs in the first year of life, predominantly within the initial three years, with a distinctive characteristic being clusters of seizures, often triggered by fever. Intellectual disability and psychiatric symptoms are noted in approximately two-thirds of cases. The severity of the phenotype appears to be associated with the age of epilepsy onset (Zuberi et al., 2022).

2.2.3.5. Glucose Transporter 1 Deficiency Syndrome (GLUT1D5)

Glut1DS is a complex neurological condition linked to a spectrum of neurological manifestations, encompassing early-onset epilepsy, movement disorders, and intellectual disability. Infants may display various seizure types, although generalized-onset seizures, particularly myoclonic, myoclonic-atonic, generalized tonic-clonic, or atypical/early onset absences, are more prevalent than focal seizures. Epilepsy stands out as the predominant initial symptom of Glut1DS, and its resistance to medication persists unless managed with the ketogenic diet. The syndrome is characterized by pathogenic variants in the SLC2A1 gene,

responsible for encoding glucose transporter type 1, leading to impaired glucose transport across the blood-brain barrier (Zuberi et al., 2022).

2.2.3.6. Sturge Weber syndrome (SWS)

SWS is an innate neurocutaneous disorder characterized by the presence of a facial capillary malformation known as a port-wine stain birthmark, accompanied by ipsilateral leptomeningeal angioma and frequent ipsilateral glaucoma. The condition results from somatic activating mutations in the guanine nucleotide–binding protein alpha-q (GNAQ) gene. The prognosis for SWS varies widely and is linked to potential complications that often emerge in early childhood, such as epilepsy, focal neurological deficits, and glaucoma. The definitive diagnosis is confirmed through brain imaging that reveals direct or indirect evidence of the leptomeningeal angioma (Zuberi et al., 2022).

2.2.3.7. Gelastic Seizures with Hypothalamic Hamartoma (GS-HH)

Hypothalamic hamartomas are exceptionally rare, congenital, non-neoplastic abnormalities that are notably linked to gelastic (laughter episodes without mirth) or, less frequently, dacrystic (crying) seizures, typically initiating in infancy or early childhood. Over time, other seizure types, such as focal impaired awareness or various generalized seizures, may emerge, accompanied by a gradual cognitive plateau or regression and progressive behavioral abnormalities like impulsiveness and aggression. Some cases may exhibit precocious puberty. While these seizures tend to resist drug treatment, surgical intervention can significantly enhance their control. Early consideration of surgical therapy is advisable to manage seizures and prevent progressive cognitive and behavioral deterioration (Zuberi et al., 2022).

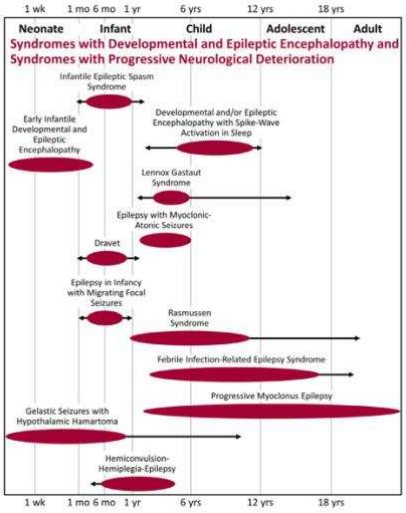

Fig. 2. Age at presentation of Syndromes with Developmental and Epileptic Encephalopathy and Syndromes with Progressive Neurological Deterioration (Wirrell et al., 2022)

2.3. Epidemiology

In Italy, the annual incidence of epilepsy is 48.35 new cases per 100,000 individuals, which aligns with comparable figures reported in other industrialized nations. The highest incidence is observed in children under the age of 15, reaching 50.14 new cases per 100,000 individuals per year. This prevalence is particularly pronounced in the initial year of life, where the incidence peaks at 92.8 new cases per 100,000 individuals per year (Minardi et al., 2019). The incidence of neonatal seizures has been reported between 1 to 5.5 per 1000 live births in term infants, with higher incidences reported in preterm infants. The incidence in the United States is estimated between 80-120 cases per 100,000 neonates per year (Krawiec and Muzio, 2023). Of these incidents, BECTS is one of the epilepsy that most often occurs in children with prevalence figures for childhood epilepsies ranging from 8% to 25%, with a general incidence rate of 10 to 20 cases per 100,000 in children aged 3 to 15 (Dryżałowski et al., 2018).

Studies generally concur that females exhibit a slightly lower incidence of epilepsy and unprovoked seizures compared to males. This discrepancy is typically explained by the higher exposure of males to risk factors associated with lesional epilepsy and acute symptomatic seizures. Conversely, idiopathic generalized epilepsies (IGEs), constituting approximately 15-20% of all epilepsy cases, are more prevalent among females (McHugh and Delanty, 2008).

2.4. Pathophysiology

The precise mechanism initiating seizures remains unknown, with potential factors being either a deficiency in neuronal inhibition or an abundance of excitatory stimuli. Many studies propose that seizure onset is contingent upon a deficit in neuronal inhibition, particularly a deficiency in γ-Aminobutyric acid (GABA), the most critical neurotransmitter in the central nervous system. Alternatively, it may result from an alteration in GABA function, leading to prolonged and intense stimulation (Kapur, 1999).

In experimental animal models, other studies have demonstrated the involvement of N-methyl-D-aspartate (NMDA) and alpha-amino-3-hydroxy-5-methyl-4-isoxazole-propionic acid, both glutamate receptors and crucial excitatory receptors in the central nervous system, in seizure physiopathology (Kapur, 1999).

Children are more susceptible to frequent infections such as respiratory tract infections, otitis media, and viral infections that induce elevated body temperature (Haspolat et al., 2002; Chiu et al., 2001)Animal models suggest the central role of inflammatory mediators like interleukin-1 (IL-1), which could lead to an increase in neuronal stimulation and the onset of febrile seizures (Haspolat et al., 2002).

2.5. Manifestation

The features of seizures exhibit variability and are contingent upon the origin of the disruption in the brain and the extent of its propagation. Transient symptoms manifest, such as a loss of awareness or consciousness, as well as disruptions in movement, sensation (including vision, hearing, and taste), mood, or other cognitive functions. Individuals with epilepsy commonly experience a heightened occurrence of physical issues, such as fractures and bruises resulting from injuries associated with seizures. Additionally, there is an elevated prevalence of psychological conditions, notably anxiety and depression (World Health Organization, 2023).

As outlined by Mayo Clinic in 2021, besides seizures without fever happening more than twice within a 24-hour period or occurring suddenly, epilepsy can also be identified by various other symptoms, such as:

- Fixed gaze

- Sudden, involuntary movements of the arms and legs
- Rigidity of the body
- Unconsciousness
- Breathing difficulties or cessation of breathing
- Inability to control bowel or bladder functions
- Abrupt falling without an evident cause, particularly in conjunction with loss of consciousness
- Brief episodes of not reacting to sounds or words
- Presenting confusion or a dazed state
- Rhythmic nodding of the head, often linked with a loss of awareness or consciousness
- Episodes of rapid eye blinking and fixed stares

2.6. Diagnosis

An accurate diagnosis of seizures and epilepsy is crucial for the efficacy of treatment. Diagnostic examinations aid in identifying the presence and location of a brain lesion that may be triggering seizures (Johns Hopkins Medicine, 2019). A physician arrives at an epilepsy diagnosis by considering symptoms, observable physical indicators, and the findings from diagnostic tests like an electroencephalogram (EEG), computed tomography (CT or CAT scan), or magnetic resonance imaging (MRI) (American Association of Neurological Surgeons, 2019). The electroencephalogram (EEG) assists in identifying the epileptic nature of seizures, enables the assessment of the risk of recurrence following an initial seizure, contributes to diagnosing epilepsy syndromes, and serves as the benchmark in presurgical evaluations for epilepsy. Furthermore, the EEG has the capability to detect subclinical seizures as a potential cause of a comatose state (Rosenow, Klein, and Hamer, 2015). Magnetic Resonance Imaging (MRI) is adept at identifying small cortical epileptogenic lesions, while computed tomography is used for screening, diagnosing, assessing, and monitoring the prognosis of seizures in pediatric patient .(Maria Alejandra Nieto-Salazar et al., 2023a).

2.7. Management

The primary objective of therapy during Status Epilepticus (SE) is to stop seizures before irreversible damage occurs to neural cells. SE becomes progressively challenging to control with prolonged duration; hence, initiating early targeted pharmacological intervention is crucial (Minardi et al., 2019).

2.7.1. General Support Measures

The initial approach in managing Status Epilepticus (SE) should prioritize airway management, ensuring adequate ventilation and circulation. Preventing injuries resulting from uncontrolled movements is crucial. Placing the patient in a lateral position is also imperative to mitigate the risk of inhalation, coupled with the insertion of a peripheral venous catheter (Minardi et al., 2019).

Continuous monitoring of vital signs, including heart rate, blood pressure, oxygen saturation, and temperature, is essential for assessing the progression of SE. Swift blood tests should be conducted to identify potential hypoglycemia or poisoning (Minardi et al., 2019).

It is noteworthy that many drugs utilized to address SE have the propensity to suppress respiratory drive. Consequently, it is crucial to take precautionary measures in recognizing and treating their potential side effects (Minardi et al., 2019)

2.7.2. Anticonvulsant Drugs

The majority of children experiencing new-onset epilepsy, particularly those with idiopathic generalized epilepsies, attain seizure freedom through the appropriate administration of antiepileptic drugs (AEDs). Approximately 20% of children with epilepsy will experience only a few seizures within the context of an idiopathic focal syndrome before spontaneous remission occurs. Nevertheless, nearly 20% of the pediatric epilepsy population will persist in experiencing seizures despite the use of AEDs, whether as monotherapy or in combination. The pharmacological for managing epilepsy in children comprises first-generation AEDs [carbamazepine (CBZ), clobazam (CLB), clonazepam (CZP), ethosuximide (ETS), phenobarbital (PB), phenytoin (PHT), sulthiame (STM), valproic acid (VPA)] and second-generation AEDs [felbamate (FBM), gabapentin (GPT), lamotrigine (LTG), levetiracetam (LEV), oxcarbazepine (OXC), pregabalin (PGB), tiagabine (TGB), topiramate (TPM), vigabatrin (GVG), zonisamide (ZNS)]. The most recently approved drugs, classified as third-generation or newer AEDs, include eslicarbazepine acetate (ESL), lacosamide (LCS), perampanel (PER), retigabine (RTG), rufinamide (RUF), and stiripentol (STP) (Rosati, De Masi, and Guerrini, 2015).

Many second- and third-generation AEDs are licensed as adjunctive treatments for epilepsy in adults, leading to their off-label use in pediatric populations, supported by an increasing body of evidence regarding their potential efficacy in children, particularly those over the age of 12 (Rosati, De Masi, and Guerrini, 2015).

Benzodiazepines are the preferred initial treatment for seizures and Status Epilepticus (SE) in pre-hospital emergency care. They enhance the inhibition of GABA receptors, exhibit a rapid onset, and prove effective in approximately 79% of SE cases. Barbiturates amplify the inhibition of GABA receptors, with Phenobarbital being among the most commonly used. Nevertheless, its prolonged half-life makes it challenging to administer. Phenobarbital and Phenytoin are classified as second-line drugs for managing seizures and SE, typically administrated when benzodiazepines prove ineffective. Common side effects include sedation, respiratory depression, and hypotension. Hence, prioritizing airway management and cardiovascular intervention becomes considered as priority (Minardi et al., 2012).

Phenobarbital is frequently used as the antiepileptic drug in neonatal seizures, with Phenytoin demonstrating comparable effectiveness. Valproic acid plays a crucial role in managing refractory Status Epilepticus (SE), as indicated in the 2017 recommendations from ILAE (International League Against Epilepsy), specifically at stage 2 (Trinka and Kälviäinen, 2017).

Propofol, an anesthetic agent possessing anticonvulsant properties, is administered in cases of refractory Status Epilepticus (SE). However, its disadvantages include a short half-life and rapid metabolism, potentially exacerbating convulsions. Primary side effects are respiratory depression and hypotension due to myocardial depression (Minardi et al., 2011; Minardi, 2012)

3. Conclusion

Childhood epilepsy reveals a complex neurological condition characterized by varying seizure types and patterns. The incidence rates differ among age groups, with neonates and young children being particularly susceptible. The diagnostic process involves a careful assessment of symptoms, physical signs, and the use of diagnostic tools such as electroencephalograms (EEGs) to establish an accurate diagnosis. Childhood epilepsy not only poses challenges related to physical safety, as evidenced by an increased risk of injuries during seizures, but also extends to psychological aspects, contributing to a higher prevalence of conditions like anxiety and depression. Effective management and treatment require a multidisciplinary approach, considering the individualized nature of each case, to optimize outcomes and improve the overall quality of life for children living with epilepsy.

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