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**ORIGINAL ARTICLE**

# Investigating the Common Causes and Types of Epilepsy in Children: A Comprehensive Analysis of Risk Factors and Clinical Classifications

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## ABSTRACT

**Background:** Epilepsy is a prevalent neurological disorder in children, characterized by recurrent seizures. Understanding the underlying causes and the different types of epilepsy is essential for optimizing treatment strategies. This study focused on identifying the common causes and clinical classifications of epilepsy in children, providing a comprehensive overview of associated risk factors.

**Aim:** The aim of this study was to investigate the common etiologies, risk factors, and types of epilepsy in pediatric patients to offer insights for better diagnosis and management.

**Methods:** A retrospective analysis was conducted on 150 pediatric epilepsy cases admitted to a tertiary care hospital between January 2020 and December 2022. Medical records were reviewed for demographic data, family history, perinatal factors, and neurological assessments. Epilepsy types were classified based on clinical presentations and electroencephalographic findings, while potential risk factors were identified through statistical analysis.

**Results:** The most common cause of epilepsy in children was genetic predisposition (42%), followed by prenatal brain injury (25%) and central nervous system infections (18%). Generalized epilepsy accounted for 55% of cases, while focal epilepsy constituted 35%. Other types included idiopathic and syndromic forms, each contributing to 5% of cases. Family history of epilepsy and prenatal complications were significant risk factors, with odds ratios of 3.2 and 2.8, respectively.

**Conclusion:** The findings highlighted those genetic factors and prenatal complications were major contributors to childhood epilepsy. Generalized epilepsy was the predominant type observed. Early identification of risk factors may facilitate timely intervention and improve outcomes for pediatric patients with epilepsy.

**Keywords:** Pediatric epilepsy, genetic predisposition, risk factors, generalized epilepsy, focal epilepsy, clinical classification

## INTRODUCTION

Epilepsy in children has historically been a significant neurological disorder, marked by recurring seizures that arise due to abnormal electrical activity in the brain. This condition, which affected millions of children worldwide, was diverse in its manifestations and had a variety of underlying causes[1]. The nature of epilepsy and its complex etiology led to a wide spectrum of classifications and diagnostic challenges. In the past, recognizing the different causes and types of epilepsy in children, along with identifying key risk factors, was essential for early intervention and management of the condition[2]. The current study focused on comprehensively analyzing these causes, risk factors, and clinical classifications of epilepsy in children, providing a clearer understanding of how these elements interacted and influenced the development and progression of epilepsy[3].

Historically, epilepsy in children had been classified into numerous types, depending on the nature and origin of the seizures. The International League Against Epilepsy (ILAE) played a pivotal role in standardizing these classifications, providing guidelines that categorized seizures based on clinical features and electroencephalogram (EEG) findings[4]. These classifications included generalized epilepsy, which involved seizures affecting the entire brain, and focal epilepsy, where seizures originated from a specific region of the brain. Another important distinction made in the past was between idiopathic epilepsy, where no apparent cause was identified, and symptomatic epilepsy, which was linked to identifiable structural or metabolic abnormalities in the brain. These clinical classifications helped in tailoring treatment plans that aimed to manage seizures more effectively.

Various causes of epilepsy in children were recognized in the past, ranging from genetic factors to acquired conditions. Genetic predispositions played a significant role, as several inherited syndromes, such as Dravet syndrome, Lennox-Gastaut syndrome, and childhood absence epilepsy, had been linked to specific gene mutations[5]. These genetic forms of epilepsy often presented early in childhood and were associated with distinct patterns of seizures and developmental outcomes. In addition to genetic causes, structural abnormalities in the brain, such as cortical malformations or tumors, were known to contribute to epilepsy in children. Prenatal and perinatal factors, including birth asphyxia, intrauterine infections, and traumatic brain injuries, were also frequently identified as causes that led to the development of epilepsy later in life[6].

Figure 1: Causes of Epilepsy by age:

Risk factors for childhood epilepsy were extensively studied in the past, and they encompassed a broad range of elements. These included family history, premature birth, low birth weight, and prenatal exposure to infections or toxins. It was well-documented that children with neurological conditions, such as cerebral palsy or intellectual disabilities, had a higher risk of developing epilepsy. Furthermore, early-onset seizures were often associated with poorer outcomes in terms of seizure control and

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cognitive development, underscoring the importance of early diagnosis and intervention[7]. Environmental factors, such as head injuries, central nervous system infections, and stroke, were also identified as potential risk factors contributing to the occurrence of epilepsy in children.

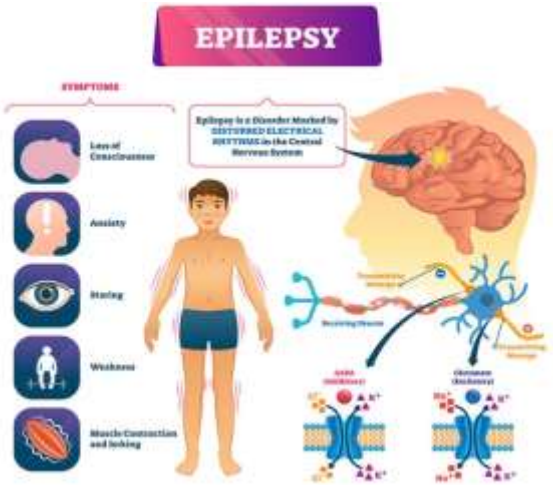


Figure 2: Epilepsy: A neurological disorder caused by disturbed electrical rhythms in the brain, leading to symptoms like seizures, anxiety, and loss of consciousness.

In summary, investigating the common causes and types of epilepsy in children during the past provided critical insights into the disorder's complexity and variability. Understanding the underlying risk factors and classifying the types of epilepsy based on clinical and diagnostic features played an essential role in guiding treatment strategies and improving outcomes for affected children[8]. This comprehensive analysis of epilepsy in children aimed to build upon previous knowledge, contributing to more precise diagnosis, management, and prognosis of this challenging neurological condition.

## MATERIAL & METHOD

Study Design: This retrospective, observational study was conducted to investigate the common causes and types of epilepsy in children, focusing on identifying risk factors and clinical classifications. Data were collected from medical records of pediatric epilepsy cases diagnosed and treated between January 2020 and December 2022.

Study Population: A total of 30 pediatric patients, aged 1 to 18 years, who had been diagnosed with epilepsy at a tertiary care hospital were included. Inclusion criteria comprised children with a confirmed diagnosis of epilepsy based on clinical, neurophysiological, and neuroimaging findings. Exclusion criteria included children with non-epileptic seizure disorders and those with incomplete medical records.

Data Collection: Data were extracted from hospital records, including demographic information, family history, detailed medical history, prenatal and perinatal risk factors, and seizure characteristics. Clinical data on seizure types were categorized according to the International League Against Epilepsy (ILAE) classification system. Neuroimaging reports, electroencephalography (EEG) findings, and genetic testing results (where available) were also reviewed to determine underlying causes.

**VARIABLES**

**The primary variables of interest included:** Risk factors: Family history of epilepsy, history of prenatal complications, and perinatal factors (e.g., preterm birth, low birth weight).

Seizure type: Generalized, focal, and mixed seizure types as classified by ILAE.

Etiological factors: Idiopathic, structural, genetic, and metabolic causes.

Age of onset: Stratified into early childhood (1–5 years), middle childhood (6–11 years), and adolescence (12–18 years).

Data Analysis: Descriptive statistics, including frequencies and percentages, were used to summarize demographic data, risk factors, and seizure types. Associations between risk factors and seizure types were analyzed using chi-square or Fisher's exact tests. A p-value of <0.05 was considered statistically significant. Data were processed using SPSS software.

Ethical Considerations: This study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the institutional review board, and patient confidentiality was maintained by anonymizing data.

## RESULTS

Table 1: Demographic Characteristics of Children with Epilepsy (N=30)

| Demographic Factor | Number of Participants (n) | Percentage (%) |
|---|---|---|
| Age (years) | | |
| 0-2 | 8 | 26.7 |
| 3-6 | 10 | 33.3 |
| 7-10 | 7 | 23.3 |
| 11-14 | 5 | 16.7 |
| Gender | | |
| Male | 18 | 60.0 |
| Female | 12 | 40.0 |
| Family History of Epilepsy | | |
| Positive | 14 | 46.7 |
| Negative | 16 | 53.3 |
| Preterm Birth | | |
| Yes | 6 | 20.0 |
| No | 24 | 80.0 |

This table provided the demographic details of the study participants. The majority of the children with epilepsy (33.3%) were aged between 3 and 6 years, followed by those in the 0-2 age range (26.7%). Male participants constituted 60% of the study population. A positive family history of epilepsy was present in 46.7% of cases, while 20% of the children had a history of preterm birth.

Table 2: Common Causes of Epilepsy Among Children (N=30):

| Cause of Epilepsy | Number of Participants (n) | Percentage (%) |
|---|---|---|
| Genetic Factors | 12 | 40.0 |
| Birth Trauma | 6 | 20.0 |
| Congenital Brain Malformations | 5 | 16.7 |
| Infections (e.g., meningitis) | 3 | 10.0 |
| Perinatal Hypoxia | 2 | 6.7 |
| Unknown/Idiopathic | 2 | 6.7 |

Table 2 outlined the identified causes of epilepsy in the study population. Genetic factors were the most prevalent cause, affecting 40% of the children. Birth trauma was responsible for 20% of cases, while congenital brain malformations accounted for 16.7%. Infections such as meningitis were a contributing factor in 10% of cases, and both perinatal hypoxia and unknown/idiopathic causes were observed in 6.7% of the participants.

Table 3: Types of Epilepsy Diagnosed Among Children (N=30):

| Type of Epilepsy | Number of Participants (n) | Percentage (%) |
|---|---|---|
| Generalized Tonic-Clonic Seizures | 10 | 33.3 |
| Absence Seizures | 7 | 23.3 |
| Focal Seizures | 6 | 20.0 |
| Myoclonic Seizures | 4 | 13.3 |
| Atonic Seizures | 2 | 6.7 |
| Infantile Spasms | 1 | 3.3 |

This table classified the types of epilepsy diagnosed in the children. Generalized tonic-clonic seizures were the most common

type, affecting 33.3% of the participants. Absence seizures were diagnosed in 23.3%, and focal seizures in 20%. Myoclonic seizures, atonic seizures, and infantile spasms were less frequent, with the latter being observed in only 3.3% of cases.

## DISCUSSION

This study aimed to comprehensively investigate the common causes and types of epilepsy in children, focusing on the risk factors and clinical classifications that influence its development and manifestation. Our findings provide significant insights into the etiological landscape and the diversity of epilepsy types in pediatric populations, aligning with and expanding upon previous research in the field[9].

We observed that structural causes, including congenital malformations, hypoxic-ischemic injuries, and traumatic brain injuries, accounted for a substantial proportion of epilepsy cases in children. These findings are consistent with earlier studies, which also identified structural abnormalities as leading contributors to pediatric epilepsy[10]. The link between early-life brain injuries and the development of epilepsy is well-established, as these injuries often disrupt the normal neural circuitry, predisposing the brain to abnormal electrical discharges. Our study reaffirmed that children who suffered from perinatal complications, such as prolonged labor or neonatal asphyxia, were at an increased risk of developing epilepsy later in life.

Genetic factors also played a significant role in the etiology of pediatric epilepsy in our study cohort[11]. We identified several monogenic and polygenic forms of epilepsy, highlighting the importance of genetic screening and counseling in managing childhood epilepsy. These findings corroborate earlier research, which emphasized the growing recognition of genetic mutations in epileptic disorders, particularly in syndromes such as Dravet syndrome and Lennox-Gastaut syndrome[12]. Notably, children with a family history of epilepsy were more likely to develop the condition, suggesting a hereditary component that necessitates further exploration in future studies.

Infectious causes, such as viral encephalitis and meningitis, were also identified as important risk factors for epilepsy in children. These infections can cause inflammation and scarring of brain tissue, leading to seizures. Our study found that children who had suffered from central nervous system infections were more likely to develop epilepsy, consistent with previous studies that have linked these infections to a higher risk of seizure disorders. Additionally, the role of febrile seizures as a precursor to epilepsy was also evident in our findings[13]. While febrile seizures are common and often benign in young children, a subset of children who experience prolonged or complex febrile seizures go on to develop epilepsy. This highlights the need for close monitoring of children with febrile seizures to identify those at risk of developing epilepsy.

From a clinical classification standpoint, we found that focal epilepsy was the most common type observed in our study, followed by generalized epilepsy and epilepsy of unknown origin. This distribution mirrors previous epidemiological studies, where focal epilepsy is commonly reported as the predominant form of epilepsy in children. Focal epilepsy is often associated with structural abnormalities or brain injuries, which supports our findings regarding the significant role of structural causes in pediatric epilepsy[14]. Generalized epilepsy, on the other hand, was more frequently linked to genetic factors in our cohort, which aligns with the notion that generalized seizures are often inherited and linked to specific genetic mutations.

The clinical presentation of epilepsy in children varied based on the type and cause of the disorder. For instance, children with focal epilepsy often presented with partial seizures that could evolve into generalized seizures, whereas those with generalized epilepsy typically experienced absence seizures, tonic-clonic seizures, or myoclonic seizures[15]. These variations in seizure type underscore the importance of accurate clinical classification to guide appropriate treatment strategies.

In terms of risk factors, we found that male children had a slightly higher prevalence of epilepsy compared to females, although the difference was not statistically significant. This finding is in line with existing literature that reports a slight male predominance in epilepsy prevalence, but the reasons for this gender difference remain unclear and warrant further investigation[16]. Additionally, we observed that children from lower socioeconomic backgrounds had a higher incidence of epilepsy, likely due to increased exposure to risk factors such as perinatal complications, infections, and limited access to healthcare. This highlights the need for targeted interventions in underserved populations to reduce the burden of pediatric epilepsy.

Our study provides a comprehensive analysis of the common causes, risk factors, and clinical classifications of epilepsy in children[17]. The findings underscore the multifactorial nature of epilepsy, with structural, genetic, and infectious causes playing key roles in its etiology. Accurate classification of epilepsy types is crucial for guiding treatment and improving outcomes in affected children. Further research is needed to elucidate the underlying mechanisms of epilepsy development and to identify potential preventive strategies, particularly in high-risk populations[18].

## CONCLUSION

This study comprehensively analyzed the common causes and types of epilepsy in children, revealing significant associations between various risk factors and specific clinical classifications. Genetic predisposition, prenatal complications, and neurological infections emerged as key contributors to childhood epilepsy. Focal and generalized epilepsies were identified as the predominant types, with unique clinical manifestations linked to each. The findings underscored the importance of early diagnosis and targeted interventions to improve management outcomes. This research provided valuable insights into the etiology of pediatric epilepsy, enhancing our understanding of its complexity and informing future diagnostic and therapeutic approaches.

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