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Prevalence of Epilepsy Syndromes in Children with Epilepsy in Damietta Governorate According to The International League Against Epilepsy Classification and Definition of Epilepsy Syndromes

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Abstract

Background: Epilepsy syndromes in children vary in prevalence across regions. In Damietta Governorate, the classification by the International League Against Epilepsy helps identify and categorize these syndromes, providing insights into regional trends and healthcare needs. The aim of the study was to determine the prevalence of epilepsy syndromes in children within Damietta Governorate, using the International League Against Epilepsy classification to provide a comprehensive understanding of regional epilepsy patterns.

Patients and Methods: This cross-sectional study included 376 children diagnosed with epilepsy based on the practical clinical definition of epilepsy by ILAE in Damietta at Al-Azhar University Hospital. Children were classified into epilepsy syndrome and none epilepsy syndrome based on standard clinical, neurophysiological and radiological criteria of each syndrome.

Results: Epilepsy syndromes were present in 99 children with a prevalence of 26.3%. In this study, 26.1% of children with epilepsy were from urban areas, and 73.9% were from rural areas, with no significant difference in epilepsy syndromes [P=0.9]. The mean gestational age was 37.9 weeks, with 67.8% delivered via cesarean section. Birth weight had no significant correlation with epilepsy syndromes [P=0.9]. Family history and consanguinity showed no impact on epilepsy prevalence. Seizure types were mostly focal [77.7%], with no significant correlation with syndromes. Medications, including Tiratam and Depakin, were comparable between syndrome groups.

Conclusion: This study highlights a 26.3% prevalence of epilepsy syndromes in children, emphasizing the need for early diagnosis, systematic evaluations, and equitable access to care.

Keywords: Epilepsy Syndromes; International League Against Epilepsy; Damietta

INTRODUCTION

Epilepsy is among the most prevalent serious neurological conditions in childhood, with over half of all seizures beginning during this stage of life. It is a highly significant non-communicable neurological disorder associated with severe stigmatization. The cumulative lifetime risk of developing epilepsy is approximately 3% [1]. In Egypt, the annual incidence of epilepsy is estimated at 82.7 per 100,000 individuals, while the prevalence among school-aged children [6–14 years] is reported to be 7.2 per 1,000 [2].

Epilepsy encompasses a diverse group of disorders characterized by varying causes, electro-clinical presentations, and clinical outcomes [3]. The 2017 classification system introduced by the International League Against Epilepsy [ILAE] defines three diagnostic levels for epilepsy: [1] seizure type, [2] epilepsy type, and [3] epilepsy syndrome. This framework highlights the importance of considering etiology and comorbidities at every level of diagnosis [4].

Although epilepsy syndromes have been recognized as distinct electro-clinical entities well before the first ILAE classification in 1985, there was no universally accepted system for categorizing these syndromes. Recently, the ILAE's Nosology and Definitions Task Force developed a series of position papers to formalize the classification of epilepsy syndromes. According to their definition, an epilepsy syndrome is identified by a distinct combination of clinical and EEG characteristics, often supported by specific etiological factors, such as structural, genetic, metabolic, immune, or infectious origins [3].

The accurate diagnosis of epilepsy syndromes in children has significant implications for treatment and prognosis. For instance, certain syndromes tend to resolve at specific ages, while others are strongly linked to intellectual, psychiatric, or other comorbidities. Additionally, some syndromes show a better response to specific therapeutic approaches [5].

In Egypt, data on the prevalence and distribution of epilepsy syndromes in children remain limited. Understanding the patterns of these syndromes in the local community can support more effective future planning and improve outcomes for children with epilepsy. The present study aims to determine the prevalence of epilepsy syndromes among children in the Damietta Governorate based on the ILAE classification. It also seeks to describe the clinical, neurophysiological, and radiological characteristics, as well as the associated comorbidities of each syndrome, to identify the most common epilepsy patterns and inform future diagnostic and therapeutic strategies.

PATIENTS And METHODS

This cross-sectional study included 376 children diagnosed with epilepsy based on the practical clinical definition of epilepsy by ILAE [6] in Damietta at Al-Azhar University Hospital. Children were classified into epilepsy syndrome and none epilepsy syndrome based on standard clinical, neurophysiological and radiological criteria of each syndrome. Our study was done under the umbrella of Helsinki declaration principals. Ethical approval was obtained from the institutional review board of Damietta faculty of medicine, Al-Azhar university. Written informed consent was obtained from the parents of every patient. We excluded children with well-defined etiology that can't be classified as epilepsy syndrome such as; children with certain structural etiologies [e.g. cerebral palsy and brain tumor], children with certain inborn errors of metabolism, children with infectious epilepsy [e.g. HIV and toxoplasmosis], children with immune epilepsy.

Sample size: The sample size was calculated using an online calculator [https://www.openepi.com], where proportion type was chosen. The following criteria were assumed: confidence limits of 5%, Design Effect of 1, anticipated frequency of epilepsy syndromes as 90% and ten thousand population size. The calculated sample size at 99,9% Confidence Level was 376 children.

Data collection: Each included patient was submitted to detailed history taking [seizures history, type of seizures and epilepsy], and complete physical examination for associated conditions. The following investigations were done for every child, Electro-encephalogram [EEG], Magnetic resonance imaging [MRI], and magnetic resonance spectroscopy [MRS] when it is necessary for diagnosis. Metabolic testing was done in certain epilepsy syndromes with metabolic etiology. The choice of these cases was based on the diagnostic criteria of **Zuberi *et al.*** [7]. Also, Genetic testing was done in strongly suggested epilepsy syndromes with no definable cause with previous investigations. The choice of these cases was based on the diagnostic criteria of **Zuberi *et al.*** [7].

Final outcomes: Based on collection of the clinical, electrophysiological and other investigations, patients were diagnosed as having certain epilepsy syndrome according to the following references: Diagnosis of epilepsy syndrome as "a characteristic cluster of clinical and EEG features, often supported by specific etiological findings [structural, genetic, metabolic, immune, and infectious]" [3]. Epilepsy syndromes with onset in neonates and infants according to **Zuberi *et al.*** [7]. Epilepsy syndromes with onset in childhood according to **Specchio *et al.*** [8]. Epilepsy syndromes with onset at a variable age according to **Riney *et al.*** [9]. Idiopathic Generalized Epilepsy Syndromes according to **Hirsch *et al.*** [10].

Statistical analysis: Statistical analysis was performed with SPSS statistical software, version 26 [IBM, Chicago, Illinois, USA]. The normality of the data was tested by the Kolmogrov-Smirnov test. Qualitative data were presented as numbers and percentages and were compared by the Chi square test, or Fisher exact test. Quantitative data were presented as mean and standard deviations and were compared by the independent t test. As a result, the p-value was considered significant at the level of <0.05.

RESULTS

A total number of 376 epileptic child were included in our study. Epilepsy syndromes were present in 99 children with a prevalence of 26.3%. The most common types were as follow; Self-limited Epilepsy with Centrotemporal Spikes [2.4%], Self-limited focal epilepsy [2.4%], Self-limited Epilepsy with Autonomic Seizures [2.4%], Genetic epilepsy with Febrile

Seizures Plus [1.9%], Self-limited [Familial] Neonatal Epilepsy [1.3%], Childhood Occipital Visual Epilepsy [1.3%], Mesial Temporal Lobe Epilepsy with Hippocampal Sclerosis [1.3%], Epilepsy with Myoclonic Absences [1.3%], Self-limited Familial Neonatal Infantile Epilepsy [1.1%], Myoclonic epilepsy in infancy [1.1%], Progressive Myoclonus Epilepsies [1.1%], Photosensitive Occipital Lobe Epilepsy [1.1%], Lennox-Gastaut Syndrome [1.1%], Epilepsy with Myoclonic Atonic Seizures [1.1%], Familial Mesial Temporal Lobe Epilepsy [1.1%], Febrile infection related epilepsy syndrome [1.1%], Early infantile DEE [0.8%], Hemiconvulsion-Hemiplegia-Epilepsy [0.8], Sleep-Related Hypermotor [Hyperkinetic] Epilepsy [0.8%], Epilepsy with Reading Induced Seizures [0.5%], and Familial Focal Epilepsy with Variable Foci [0.5%] [Table 1].

According to the demographic data, the mean age was 5.1 ± 3.9 years with a range of 0.008–15 years. Male patients represent 51.9% however the female patients represent 51.5%. The demographic factors were comparable in both epileptic syndrome and non-epileptic syndrome patients [P>0.05 for age and gender] [Table 2]. Residency showed that, 26.1% were from urban areas versus 73.9% were from rural areas, with no statistically significant difference between epileptic syndrome and non-epileptic syndrome patients [P=0.9] [Table 2]. The mean gestational age was 37.9 ± 1.1 years with arrange of 36 – 40 years. Cesarean section represents 67.8% and the normal delivery represents 32.2%. There was no significant difference between both syndrome and no syndrome patients [P=0.9 for both]. The mean birth weight was 3007 ± 373 with a range of 2200 – 3850, with no statistically significant correlation between the birth weight and the prevalence of epileptic syndromes [P=0.9] [Table 3].

In terms of the family history of epilepsy and consanguinity, positive family history was found in 245 children [65.2%], and also positive consanguinity was found in 123 children [32.7%] with no statistically significant correlation between the family history or consanguinity and the incidence of epilepsy syndromes [P=0.9 for both] [Table 3].

In our study, the mean Age at onset of epilepsy was 2 ± 1.5 years, with no difference between syndrome and non- syndrome [P=0.9]. According to the Additional neurological impairments it was present in 134 patients [35.6%] of the total studied children, 36 of them were with epilepsy syndromes and 98 were from were with non-epilepsy syndromes [P=0.9]. The Developmental delay was found in 99 children [26.3%], with no significant correlation between both syndrome and non-syndromes [P=0.9]. Febrile seizure was found in 32.3% of the children with epilepsy syndromes and 32.3% of the children with non-epilepsy syndromes [P=0.7] In terms of the seizure types, focal represent 77.7%, generalized represent 19.1%, and the epileptic encephalopathy was associated with 3.2%. There was no statistically significant correlation between the epileptic syndrome children and non-epileptic syndromes in terms seizure type [P=0.8] [Table 4].

As regards the medications that was taken by the cases, 247 children [65.7%] were on tiratam and depakin, 19.4% were on kativarox, 10.6% didn't receive any medical treatment. The epileptic syndrome patients and non-syndromes were comparable in terms of the used medications [P=0.9] [Table 5].

Table [1]: Prevalence and types of Epilepsy syndromes.

Epilepsy syndromes	N	%
Total prevalence	99	26.3
Early infantile DEE	3	0.8
Self-limited Epilepsy with Centrotemporal Spikes	9	2.4
Self-limited [Familial] Neonatal Epilepsy	5	1.3
Self-limited Familial Neonatal Infantile Epilepsy	4	1.1
Genetic epilepsy with Febrile Seizures Plus	7	1.9
Self-limited focal epilepsy	9	2.4
Self-limited Epilepsy with Autonomic Seizures	9	2.4
Childhood Occipital Visual Epilepsy	5	1.3
Myoclonic epilepsy in infancy	4	1.1
Progressive Myoclonus Epilepsies	4	1.1
Hemiconvulsion-Hemiplegia-Epilepsy	3	0.8
Photosensitive Occipital Lobe Epilepsy	4	1.1
Lennox-Gastaut Syndrome	4	1.1
Epilepsy with Reading Induced Seizures	2	.5
Epilepsy with Myoclonic Atonic Seizures	4	1.1
Familial Mesial Temporal Lobe Epilepsy	4	1.1
Mesial Temporal Lobe Epilepsy with Hippocampal Sclerosis	5	1.3
Sleep-Related Hypermotor [Hyperkinetic] Epilepsy	3	0.8
Familial Focal Epilepsy with Variable Foci	2	0.5
Febrile infection related epilepsy syndrome	4	1.1
Epilepsy with Myoclonic Absences	5	1.3

Table [2]: Demographic data of the studied patients.

Variables		Total [N= 376]	Group 1 [Epilepsy syndromes] [N=99]	Group 2 [Epilepsy] [N=277]	P value
Age[years]	**Mean ± SD**	5.1 ± 3.9	5.1 ± 3.9	5.1 ± 3.9	>0.05
	Range	0.008 – 15	0.008 – 15	0.008 – 15	
Gender [n,%]	**Males**	195 [51.9%]	51 [51.5%]	144 [52%]	>0.05
	Females	181 [48.1%]	48 [48.5%]	133 [48%]	
Residency [n,%]	**Urban**	98 [26.1%]	26 [26.3%]	72 [26%]	>0.05
	Rural	278 [73.9%]	73 [73.3%]	205 [74%]	

Table [3]: Gestational age and type of delivery of the studied participants

Variables		Total [N= 376]	Group 1 [Epilepsy syndromes] [N=99]	Group 2 [Epilepsy] [N=277]	P value
Gestational age [weeks]	**Mean ± SD**	37.9 ± 1.1	37.9 ± 1.1	37.9 ± 1.1	>0.05
	Range	36 – 40	36 – 40	36 – 40	
Type of delivery [n,%]	**Cesarean**	255 [67.8%]	67 [67.7%]	188 [67.9%]	>0.05
	NVD	121 [32.2%]	32 [32.3%]	89 [32.1%]	
Birth weight [g]	**Mean ± SD**	3007 ± 373	3010 ± 375	3006 ± 373	>0.05
	Range	2200 - 3850	2200 - 3850	2200 - 3850	
Positive family history [n,%]		245 [65.2%]	64 [64.6%]	181 [65.3%]	>0.05
Consanguinity [n,%]		123 [32.7%]	32 [32.3%]	91 [32.9%]	>0.05

Table [4]: Predictors of epilepsy syndromes

Variables	Total [N= 376]	Group 1 [Epilepsy syndromes] [N=99]	Group 2 [Epilepsy] [N=277]	P value
Age at onset of epilepsy	2 ± 1.5	2 ± 1.5	2 ± 1.5	>0.05
Additional neurological impairments	134 [35.6%]	36 [36.4%]	98 [35.4%]	>0.05
Developmental delay at onset	99 [26.3%]	26 [26.3%]	73 [26.4%]	>0.05
Febrile before afebrile seizure	117 [31.1%]	32 [32.3%]	85 [30.7%]	>0.05
Seizure types				
Focal	292 [77.7%]	75 [75.8%]	217 [78.3%]	>0.05
Generalized	72 [19.1%]	21 [21.2%]	51 [18.4%]	
Syndromes with Epileptic Encephalopathy	12 [3.2%]	3 [3%]	9 [3.2%]	

Table [5]: medications that was taken by the cases

Variables	Total [N= 376]	Group 1 [Epilepsy syndromes] [N=99]	Group 2 [Epilepsy] [N=277]	P value
No	40 [10.6%]	10 [10.1%]	30 [10.8%]	>0.05
Tiratam	4 [1.1%]	1 [1%]	3 [1.1%]	
Tiratam depakine	247 [65.7%]	66 [66.7%]	181 [65.3%]	
kativarox	73 [19.4%]	19 [19.2%]	54 [19.5%]	
Trileptal	8 [2.1%]	2 [2%]	6 [2.2%]	
Eslezipine	4 [1.1%]	1 [1%]	3 [1.1%]	

DISCUSSION

This study aimed to assess the prevalence of epilepsy syndromes in children with epilepsy, employing the International League Against Epilepsy [ILAE] classification to identify patterns and associated comorbidities. The results demonstrated a prevalence of 26.3% for epilepsy syndromes among children with epilepsy, highlighting a significant subset of pediatric patients affected by identifiable syndromes. This discussion elaborates on these findings, comparing them with existing literature, exploring clinical implications, and proposing future research directions.

In this study, 376 individuals were diagnosed with epilepsy, comprising 195 males [51.9%] and 181 females [48.1%], all within the specified age range from birth to 18 years and older. Comparatively, **Farghaly *et al.*** [11] reported a slightly lower total, with 350 individuals diagnosed with epilepsy within the birth to ≤18 years age range, including 193 males [55.1%] and 157 females [44.9%]. **Mahmoud *et al.*** [12] found 7.2/1000 lifetime epilepsy prevalence in Minia city primary kids. **El-Motayam *et al.*** [13] found a prevalence of 7-10/1000 among school children under 15 years old.

Studies conducted in Egypt have shown far lower prevalence rates as compared to other regions, such Tehran and Brazil. The frequency was found to be 45.2 per 1,000 among Brazilian children aged 5 [14], while for Tehran pupils aged 12 it was 32.4 per 1,000 [15]. Both studies reported the lifetime prevalence of seizures instead of epilepsy, which does not need seizure recurrence, which may explain the higher prevalence rates. In

light of this, the study's lifetime prevalence of epilepsy is lower than that in the United States, a highly industrialized nation, where an estimated 10.2 per 1,000 children aged 1–17 years had epilepsy or seizure disorders [16].

The prevalence of epilepsy syndromes in this study aligns closely with findings from previous research. Studies in various regions have reported similar prevalence rates, typically ranging from 20% to 30% **Scheffer *et al.* [17].** The most common syndromes identified in our cohort were Self-limited Epilepsy with Centrotemporal Spikes [2.4%] and Self-limited Focal Epilepsy [2.4%], consistent with the literature emphasizing these as prevalent syndromes in childhood epilepsy **Wirrell *et al.* [18].** These conditions are often characterized by their benign prognosis, particularly when diagnosed and managed early.

Other syndromes, such as Genetic Epilepsy with Febrile Seizures Plus [1.9%] and Mesial Temporal Lobe Epilepsy with Hippocampal Sclerosis [1.3%], also emerged as notable types. The relatively lower prevalence of severe syndromes like Lennox-Gastaut Syndrome [1.1%] and Early Infantile Developmental and Epileptic Encephalopathy [0.8%] highlights the spectrum of epilepsy syndromes, from benign to severe. These findings emphasize the importance of accurate classification, as the prognosis and management strategies differ considerably across syndromes **Berg *et al.* [19].**

The mean age of participants was 5.1 ± 3.9 years. The prevalence of epilepsy was higher in males than females. Most epilepsy studies show boys predominate [15,20]. In our study we found no significant gender difference in the prevalence of epilepsy syndromes. This finding aligns with earlier studies that suggest a balanced gender distribution in most epilepsy syndromes [21]. Similarly, the lack of significant differences in gestational age, birth weight, and delivery type between children with and without epilepsy syndromes suggests that these factors may not play a pivotal role in the development of identifiable epilepsy syndromes. However, the high prevalence of positive family history [65.2%] and consanguinity [32.7%] in the study population deserves attention. Although these factors did not show a statistically significant correlation with the prevalence of epilepsy syndromes, they remain critical in understanding the genetic predisposition to epilepsy. Studies have consistently highlighted the role of genetic factors in epilepsy syndromes, particularly in familial syndromes such as Genetic Epilepsy with Febrile Seizures Plus [22].

In our study, most of the child were from rural areas 278 [73.9%]. Consequently, 78% of the epileptic children and adolescents living in Asyut, Egypt, came from rural areas, according to Kandil and colleagues [23]. No statistically significant relationship between residency and epilepsy syndrome prevalence was found, though.

Epileptic encephalopathies accounted for 3.2% of cases, underscoring the need for heightened awareness and early diagnosis in this subgroup. These syndromes, such as Lennox-Gastaut Syndrome, are often associated with severe outcomes, including cognitive impairment and resistance to treatment [24]. The comparable seizure type distribution between syndrome and non-syndrome groups [P=0.8] suggests that seizure semiology alone may not suffice for syndrome diagnosis, necessitating comprehensive assessments.

Additional neurological impairments were present in 35.6% of the total cohort, with no significant difference between syndrome and non-syndrome groups. Developmental delays were observed in 26.3% of children, further highlighting the burden of comorbidities in pediatric epilepsy. These findings emphasize the need for a multidisciplinary approach to epilepsy management, addressing both seizure control and developmental support. Febrile seizures were documented in 32.3% of children, irrespective of syndrome classification. While febrile seizures are common in the general pediatric population, their association with specific epilepsy syndromes, such as Genetic Epilepsy with Febrile Seizures Plus, warrants closer investigation.

In our cohort, the majority of children [65.7%] were managed with Levetiracetam and Valproate, consistent with their efficacy in treating both focal and generalized seizures. The comparable medication usage between syndrome and non-syndrome groups [P=0.9] highlights the overlap in pharmacological management. However, the syndromic diagnosis can influence the choice of medications, particularly in syndromes like Lennox-Gastaut Syndrome, where specific therapies, such as cannabidiol and Rufinamide, have demonstrated effectiveness. The finding that 10.6% of children did not receive any medical treatment raises concerns about potential gaps in access to care or delays in diagnosis. Addressing these gaps through improved healthcare infrastructure and awareness campaigns is critical, particularly in rural areas, which constituted 73.9% of the study population.

The identification of epilepsy syndromes in 26.3% of children underscores the importance of systematic evaluations using the ILAE classification. Comprehensive diagnostic approaches, including detailed clinical histories, EEG, and neuroimaging, are essential for accurate syndrome identification. Early diagnosis can facilitate tailored management plans, potentially improving outcomes and quality of life for affected children.

The findings also highlight the need for capacity building among healthcare professionals in recognizing and managing epilepsy syndromes. Training programs focused on syndrome-specific characteristics and management strategies can enhance diagnostic accuracy and treatment outcomes.

While this study provides valuable insights, certain limitations warrant consideration. First, the cross-sectional design precludes longitudinal assessments of syndrome evolution and treatment outcomes. Second, the reliance on hospital-based data may limit generalizability to the broader population. Community-based studies could provide a more comprehensive understanding of epilepsy syndromes in diverse settings. Future research should explore genetic and environmental factors contributing to epilepsy syndromes, leveraging advances in genomics and neuroimaging. Additionally, longitudinal studies assessing the long-term outcomes of children with epilepsy syndromes are crucial for optimizing care pathways. Investigating the impact of early interventions and emerging therapies on developmental and cognitive outcomes will further enhance the evidence base for managing pediatric epilepsy.

Conclusion: This study highlights a 26.3% prevalence of epilepsy syndromes in children with epilepsy, with Self-limited

Epilepsy with Centrotemporal Spikes and Self-limited Focal Epilepsy being the most common types. The findings underscore the importance of systematic evaluations and early diagnosis using the ILAE classification. Addressing the high burden of comorbidities and ensuring equitable access to care are critical priorities.

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