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Research Article

Epilepsy Classification (ILAE Classification 2017) in Resource-limited Countries: A Cross-sectional Study on Epilepsy in Pediatric Patients from Sudan

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Abstract

Background: The objective of this study is to utilize the ILAE 2017 to classify epilepsy patients and determine its applicability in Sudan.

Methods: This study is a prospective, descriptive, cross-sectional research conducted in two pediatric epilepsy clinics in Khartoum State, Sudan.

Results: In this cross-sectional study, 350 pediatric patients with epilepsy were included, with a mean age of 8.4 ± 4.7 years and a mean illness duration of 4.71 ± 3.91 years. The ILAE classification was applied, showing that 71.11% of patients had generalized onset seizures, 27.7% had focal onset seizures, and only 1.1% had unknown onset seizures. Among patients with focal onset seizures, 56.4% had intact awareness, while 43.6% had impaired levels of awareness. The majority of patients who had generalized onset seizures experienced motor onset seizures, with tonic-clonic seizures being the most common (44.2%). Nearly all patients with unknown onset seizures experienced tonic-clonic convulsions. These findings provide insights into the prevalence and types of seizures among pediatric epilepsy patients in Sudan and can guide clinicians in developing appropriate treatment plans.

Conclusion: This study highlights the importance of utilizing the latest ILAE classification 2017 in epilepsy classification and its potential utilization in resource-limited areas like Sudan.

Keywords: epilepsy, classification, ILAE, Sudanese, children

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1. Introduction

The revision and modification of seizure classification, which began in 1981, was influenced by several factors. For instance, tonic seizures and epileptic spasms could have either focal or generalized onset. Additionally, some terms used in seizure classification, such as “simple partial” and “complex partial,” were deemed inappropriate [1]. Meanwhile, some types of seizures were not included in the 1981 classification. The International League Against Epilepsy (ILAE; 2017) classification introduces a new concept of describing seizure onset, awareness in focal seizures, and motor/non-motor onset in generalized and focal seizures. The aim of this study was to classify individuals with epilepsy using the ILAE 2017 Classification and evaluate its feasibility in resource-limited countries such as Sudan [2].

Before the ILAE classification system was adopted, Sudan used a classification system based on the traditional classification of epileptic seizures into grand mal, petit mal, and psychomotor [3]. The ILAE system is more comprehensive and detailed, and is based on the semiological description of seizures and etiology [4]. This system provides a more accurate and precise classification of epileptic seizures and is better suited to clinical practice. The shift to this new system will improve diagnosis and facilitate better management of patients with epilepsy [5].

The specific epilepsy classification system used in Sudan before the adoption of the ILAE 2017 classification is not mentioned in the available literature. However, a comparison study conducted in Uganda, which is a neighboring country to Sudan, compared the International Classification of Diseases (ICD-10) with the ILAE 2017 classification [6].The study revealed limitations in accurately classifying certain seizure types using the ICD-10 classification, which could result in misdiagnosis and inappropriate treatment. This finding indicates the need for a more reliable classification system.

The decision to shift to the ILAE 2017 classification system in Sudan was motivated by the aim to provide a more comprehensive and accurate classification of seizures and epilepsy syndromes. The ILAE classification system is based on up-to-date scientific evidence and consensus among experts in the field, which is expected to enhance the diagnosis, treatment, and research of epilepsy [7].

Although there are no specific studies available that investigate the implementation of the ILAE classification system in Sudan, a systematic review and meta-analysis of epilepsy in Sudan indicated a lack of standardized diagnostic and treatment protocols for the condition in the country [8]. Implementing the new classification system

may potentially address this issue by providing a standardized framework for epilepsy diagnosis and treatment.

However, it is important to consider that the effectiveness of the ILAE classification system in low-resource settings like Sudan may be influenced by factors such as limited access to diagnostic tools and medications. Therefore, further research is needed to evaluate the practical implications of implementing the ILAE classification system in Sudan and other low-resource settings.

In conclusion, based on the available literature, the ILAE classification system offers improvements over previous systems. However, more evidence and research are necessary to fully understand its potential impact on clinical practice in Sudan and other similar settings with limited resources.

2. Methods

This prospective, cross-sectional, and descriptive study was conducted in two pediatric epilepsy clinics in Khartoum State, Sudan. Patients aged between 2 months and 18 years attending the clinic between January and April 2020 were enrolled. The study involved a total of 30–50 patients per clinic referred from various Sudanese states. One of the two pediatric neurologists, three specialists, and four to six pediatric residents covered the clinic, with one taking the final classification.

2.1. Case definition

Epilepsy was diagnosed if a patient had at least two unprovoked epileptic seizures without any immediately identifiable cause [1].

Before the ILAE classification system was adopted in Sudan, the classification of epilepsies was based on the etiology or presumed etiology of the condition. The rationale behind shifting to the new system is that it provides more precise and consistent diagnosis of epilepsy, as well as better guidance for treatment. It is expected that the new system will improve the management of epilepsy by providing a more accurate and comprehensive approach to diagnosis and treatment.

2.2. Epilepsy classification

The patients' epilepsy classification was based on the ILAE classification 2017. The determination involved evaluating seizure onset (focal/generalized/unknown) through

behavioral signs, personal interviews, and EEG findings. Recorded videos of the event were also used. Patients with focal seizures were further classified according to the level of consciousness, impaired or unimpaired, and focal to generalized tonic-clonic types. Similarly, focal and generalized onset seizures were classified according to motor or non-motor onset. Seizures of unknown onset were considered when the tonic-clonic seizure became obscure. Seizures were considered unclassified if information was insufficient or if they could not fit into any category.

2.3. Investigations

At the beginning of the study, all patients underwent an electroencephalography (EEG) using the 10–20 system with photic stimulation and hyperventilation procedures when required. However, patients did not undergo video-telemetry EEG or ambulatory EEG recording as these were unavailable in the study setting. Interpretation and reporting of EEGs were done by a pediatric EEG-specialized adult neurophysiologist.

3. Results

The study included 350 patients with a mean age of 8.4 ± 4.7 years and a mean illness duration of 4.71 ± 3.91 years. The study had a male to female ratio of 1.5:1, and the mean age of seizure onset was 3.73 ± 3.73 years.

The ILAE Classification was applied, and the results indicated that 71.7% of patients (*n* = 251) had generalized onset seizures, 27.1% (*n* = 95) had focal onset seizures, and only 1.1% (*n* = 4) had unknown onset seizures. Among the patients with focal onset seizures, 56.4% (*n* = 53) had intact awareness, while 43.6% (*n* = 41) had impaired levels of awareness. Additionally, 70.5% (*n* = 67) of the patients had focal motor onset seizures, 15.8% (*n* = 15) had non-motor onset seizures, and 13.7% (*n* = 13) had focal to bilateral tonic-clonic seizures. Further details regarding focal motor and non-motor seizures are available in Table 1.

The findings from this study indicate that 95.2% of patients who had generalized onset seizures experienced motor onset seizures, while the remaining 4.8% had non-motor onset seizures. Of the patients with motor onset seizures, 44.2% experienced tonic-clonic seizures, 19.6% had tonic seizures, 15.4% had clonic seizures, 7.9% experienced myoclonic seizures, 9.6% had atonic seizures, 2.9% reported epileptic spasms, and 0.4% experienced myoclonic tonic-clonic seizures. Only two (18.2%) patients with generalized non-motor onset seizures had myoclonia of the eyelids, while the remaining eight (72.7%)

Table 1: Focal onset seizure classification (n = 95).

				Number	%
Focal onset seizure (n = 95)	Aware (n = 53)	Focal	Motor	31	58.5%
			Non motor	14	26.4%
			Focal to bilateral tonic clonic	8	15.1%
	Impaired (n = 42)	Focal	Motor	36	85.7%
			Non motor	1	2.4%
			Focal to bilateral tonic clonic	5	11.9%
Focal onset seizure (n = 95)	Motor			67	70.5%
	Non motor			15	15.8%
	Focal to bilateral tonic clonic			13	13.7%
Focal onset seizure with motor onset (n = 67)	Automatism			0	0.0%
	Atonic			1	1.5%
	Clonic			47	70.1%
	Epileptic spasm			0	0.0%
	Hyperkinetic			0	0.0%
	Myoclonic			14	20.9%
	Tonic			5	7.5%
Focal onset seizure with non-motor onset (n = 15)	Autonomic			1	6.7%
	Behavior arrest			1	6.7%
	Cognitive			0	0.0%
	Emotional			6	40.0%
	Sensory			7	46.7%

n: number of participants.

experienced atypical seizures, with only one (9.1%) having typical seizures (see Table 2).

The findings from this study indicate that 75% of patients who had unknown onset seizures experienced motor onset seizures, while the remaining 25% had unclassified onset seizures. Of the patients with motor onset seizures, all of them experienced tonic-clonic convulsions (see Table 3).

Table 2: Generalized onset seizure classifications (*n* = 251).

	Types	Number	%
Generalized onset seizure	Motor	239	95.2
	Non-motor	012	04.8
Generalized onset seizure with motor onset	Tonic clonic	106	44.2
	Clonic	037	15.4
	Tonic	047	19.6
	Myoclonic	019	07.9
	Myoclonic _tonic _clonic	001	00.4
	Myoclonic _atonic	000	00.0
	Atonic	023	09.6
	Epileptic spasm	007	02.9
Generalized onset seizure with non-motor onset	Typical	001	09.1
	Atypical	008	72.7
	Eyelid Myoclonia	002	18.2

n: number of participants.

Table 3: Unknown onset seizure classifications (*n* = 4).

		Number	%
Unknown onset seizure	Motor	3	75.0%
	Behavior arrest	0	0.0%
	Unclassified	1	25.0%
Unknown onset seizure with motor onset	Tonic clonic	3	100.0%
	Epileptic spasm	0	0.0%

n: number of participants.

4. Discussion

The researchers utilized the ILAE Classification 2017, with 99.7% of the patients being fully classified. While few studies have used the ILAE Classification 2017, this study employed the classification system to investigate epilepsy syndrome classification. The study showed that the majority of patients had generalized onset seizures, while one-third had a focal onset. These findings were similar to those reported by Badrelddin *et al.* from Sudan [9] and Selina H Banu *et al*. from Bangladesh [6], although they used the ILAE Classification 2010. However, Suvasini *et al.* from India used the ILAE Classification 2017 and found that focal onset seizures were the most frequent. Nevertheless, this study's results showed that generalized onset seizures with motor onset were the most common [10].

The study also reported that most patients experienced generalized motor onset seizures, which is consistent with the findings of Suvasini *et al.* from India. Furthermore, most patients with unknown onset seizures exhibited a motor pattern, with almost all of them presenting with the tonic-clonic seizure type, which has been similarly observed in studies by Suvasini *et al.* and Gowda *et al.* [10,11].

Standard EEG recordings without video-telemetry or ambulatory EEG monitoring have certain limitations. They provide a snapshot of brain activity during the recording session, making it challenging to capture infrequent or intermittent seizure activity [12]. Some seizure types, such as non-convulsive seizures or those with subtle symptoms, may be difficult to diagnose solely based on standard EEG recordings. Video-telemetry or ambulatory EEG monitoring, which offer continuous monitoring over an extended period, increase the likelihood of capturing these types of seizures [13].

The expertise and experience of the neurophysiologist interpreting the EEG recordings play a crucial role in accurate diagnosis. If the EEG reporting is done by a pediatric EEG-specialized adult neurophysiologist, their specialized training and experience can contribute to more accurate diagnoses [14]. In the absence of video-telemetry or ambulatory EEG recordings, taking into account the clinical context and correlation with the patient's symptoms and history becomes essential. Gathering a detailed history from the patient and caregivers, along with relevant clinical observations, can aid in the interpretation and accuracy of the EEG diagnosis [1].

Determining the specific epilepsy syndrome diagnosis is crucial once epilepsy is diagnosed. The ILAE classification of 2017 includes a list of causes in every phase, emphasizing the significance of considering the epilepsy etiology when obtaining a diagnosis as it can exhibit effective treatment outcomes. The etiology of epilepsy is categorized into six subgroups, selected for their probability of producing therapeutic benefits. Furthermore, the new classification incorporates new terminologies such as epileptic and developmental encephalopathy.

5. Conclusion

The introduction of the ILAE classification system marks a significant advancement in the field of epilepsy diagnosis and treatment. This comprehensive and detailed approach, which relies on the thorough description of seizure characteristics and their underlying causes, greatly enhances the precision and accuracy of epileptic seizure classification. The adoption of this new classification system is expected to bring numerous advantages to clinical practice in Sudan, including enhanced diagnostic

reliability and improved management of patients with epilepsy. Ultimately, this transition will result in more accurate and efficient diagnosis and treatment of epilepsy cases.

The study on epilepsy classification in Sudan reveals that the ILAE 2017 classification is applicable to most patients in resource-limited settings. It emphasizes the significance of using standardized guidelines for epilepsy management. The study also found that Sudan has the required tools for diagnosis and treatment, including EEG machines and anti-epileptic drugs, easily accessible, indicating a positive development. However, it highlights the need for further improvement in resources and infrastructure in such settings to enhance epilepsy management and outcomes.

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Ethical Considerations

The research study was approved by the Sudan Medical Specialization Board (SMSB) Ethics and Research Committee. Parents or caregivers were given informed and written consent was taken in plain Arabic language after being briefed about the study's objective.

Competing Interests

The authors declare no competing interests.

Availability of Data and Material

The data and materials used in this study are available upon request from the corresponding author.

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