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Comparison of 2017 ILAE and Semiological seizure classifications before and after video-EEG monitoring in childhood epilepsy

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Abstract. – OBJECTIVE: Our aim in this study is to evaluate epilepsy classification in children with epilepsy before monitoring (based on information received from the family) and after monitoring (based on video-EEG) by comparing two separate classification systems, namely the 2017 International League Against Epilepsy (ILAE) and Semiological Seizure Classification (SSC) systems. Classifications and methods were compared in terms of simplicity, intelligibility, and applicability during daily outpatient care.

PATIENTS AND METHODS: The study was performed with 230 recorded seizures of 173 patients aged between 1 and 18 years who underwent video-EEG monitoring and clinical seizure recordings. Seizure types and video-EEG data of the patients were recorded. Seizures were first classified based on information obtained from the parents of the patients in interviews, recorded as "before video-EEG monitoring classification," and a second characterization, based on video EEG-monitoring, was subsequently recorded as "after video-EEG monitoring classification". The consistency of both seizure classifications was evaluated.

RESULTS: For both classifications, autonomic seizures were the least congruent seizures (κ=0.27, κ=-0.005). The families generally described the seizures very well; the consistency before and after video-EEG monitoring was good. Focal seizures with impaired awareness were most common in the 2017 ILAE classification (κ=0.6), while for the SSC simple motor seizures were most common (κ=0.84). Among subtypes, clonic-tonic seizures were the most common, and the second most common subtype was dialeptic (κ=0.67). Overall, the harmony between the SSC and ILAE systems was good. The rate of good and excellent coefficients of concordance for both the SSC and 2017 ILAE was determined as 77.8% for the expanded SSC, 48% for the 2017 ILAE, 71.4% for the basic SSC, and 60% for the 2017 ILAE.

CONCLUSIONS: In practice, it is difficult to determine seizure patterns reliably in cases of childhood epilepsy. Parents, however, can generally describe seizures very well. Although the SSC seems to be superior, both the SSC and 2017 ILAE systems can be applied in daily use. Such classification enables the rise of new concepts and a better understanding of disease groups. The continuing development of classification systems will lead to advancements for patients.

Key Words:
2017 ILAE classification, Semiological seizure classification, Seizure, Video-EEG.

Introduction

Seizures are defined as temporary signs and/or symptoms caused by abnormally excessive or synchronous neuronal activity. The clinician's first duty is to discern whether an event is a seizure or a psychogenic nonepileptic seizure, such as convulsive syncope, parasomnia, movement disorders, and other nonepileptic events[1]. The next step is the classification of seizure type. Classification of seizure type is only part of the seizure description. Classification serves several purposes: it provides a communication window for clinical use, and it makes the event understandable for patients and their families. It also allows for the estimation of seizure types, potential triggers, prognosis, and risks of comorbidities. In addition, it groups patients for treatment and guides the selection of antiepileptic treatments[2].

Numerous classifications have been developed and suggested to date. The classification of epilepsy is based on various factors including seizure type, age at onset, electroencephalography (EEG) findings, magnetic resonance imaging results, and other medical tests and clinical characteristics. The 1981 and 1989 classifications of the International League Against Epilepsy (ILAE) included "specific electroclinical syndromes that depend on seizure type and etiology, and wide syndrome categories", while another classifica-

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tion system, the Semiological Seizure Classification (SSC), was suggested in 1998. The SSC is applied independently of EEG results and additional tests, based solely on clinical signs[3,4]. Loddenkemper et al[5] developed a five-dimensional epilepsy classification, including variables of epileptogenic zone, seizure semiology, seizure frequency, etiology, and comorbidities in 2005. Berg et al[6] emphasized the importance of age at the time of onset of childhood epilepsy in 2010[4] and, finally, the 2017 ILAE seizure classification system includes etiology at every stage, rather than being a classification of electroencephalographic ictal or subclinical models[7].

The 1981 and 1989 ILAE classifications are not as practical as the SSC in terms of speed of use or applicability in diverse clinical settings[4-6]. However, the 2017 ILAE classification covers the major characteristics of seizures, and it takes seizure onset zone, whether the patient is aware during the seizure, and other characteristics of seizures as its basis. Furthermore, it recommends a basic seizure classification for clinicians not specialized in epilepsy and an expanded seizure classification for clinicians specialized in epilepsy (Figures 1 and 2). The expected outcome of the 2017 ILAE seizure classification is a better identification of seizures that did not fit into previous categories together with the provision of clearer terminology for both medical and non-medical circles[7].

Luders et al[4] proposed an epileptic seizure classification system based on ictal semiology. Ictal symptoms in the SSC constitute a classification based on epileptic interference from one of the four sensory, consciousness, autonomic, or motor domains (Figure 3). In practice, it is difficult to determine seizure patterns reliably in childhood epilepsy. Seizure classifications made with video-EEG monitoring are the most reliable seizure classifications. Video-EEG monitoring was initially limited to evaluations for epilepsy surgery[4]. However, with the more widespread use of video-EEG, it is now applied for the diagnosis of paroxysmal events, determination of seizure types and epileptic syndromes, evaluation of resistant epilepsy, and identification of epilepsy surgery candidates[8]. The negative aspects of video-EEG are its high cost and the necessity of the child adapting to EEG monitoring.

Pediatric studies have been focused on some specific points of video-EEG, such as assigning a specific diagnosis of epileptic syndrome according to the ILAE classification, the semiology of partial seizures, or the study of non-epileptic events. There are few studies[9-11] dealing with the reliability of semiological interpretations derived from seizure descriptions.

In the present study, for patients with epilepsy, pre-monitoring based on family information and post-monitoring based on video-EEG were evaluated for a comparison of the 2017 ILAE and SSC systems. Our aim in doing so was to investigate the effects of video-EEG on both classifications and compare the systems in terms of applicability and intelligibility.

Patients and Methods

Patients and Demographics

Two hundred and thirty recorded seizures of 173 patients aged between 1 and 18 years who underwent video-EEG monitoring and seizure recording in the Gazi University Faculty of Medicine's video-EEG laboratory between January 2016 and January 2019 were examined retrospectively. Seizure types and video-EEG data were recorded for each patient.

Video-EEG Monitoring

Scalp electrodes were placed according to the international 10-20 system with extra electrodes for the anterior temporal region with records produced using a Nihon Kohden Neurofax EEG 1200. The video and EEG records were synchronized with a closed-circuit system. Patients were monitored for 1-7 days until clinical seizures were recorded. Trained EEG technicians and nurses examined the patients to evaluate their levels of consciousness and motor responses throughout the seizures.

Seizure Classifications

At the beginning of the study, two blinded pediatric neurologists (EA and HKU) and a non-blinded pediatric neurologist (AS) were assigned to the video-EEG reports as investigators. The families also provided seizure descriptions along with the video-EEG recordings. A total of 230 seizures experienced by 173 patients were evaluated, and 184 seizure descriptions from the families were also included in the study.

All seizures were recorded by AS (non-blinded researcher) based on the seizure descriptions obtained from families. Seizures were initially classified based on the SSC and 2017 ILAE systems by the blinded investigators (HKU, EA) based on that information. This first round of classification

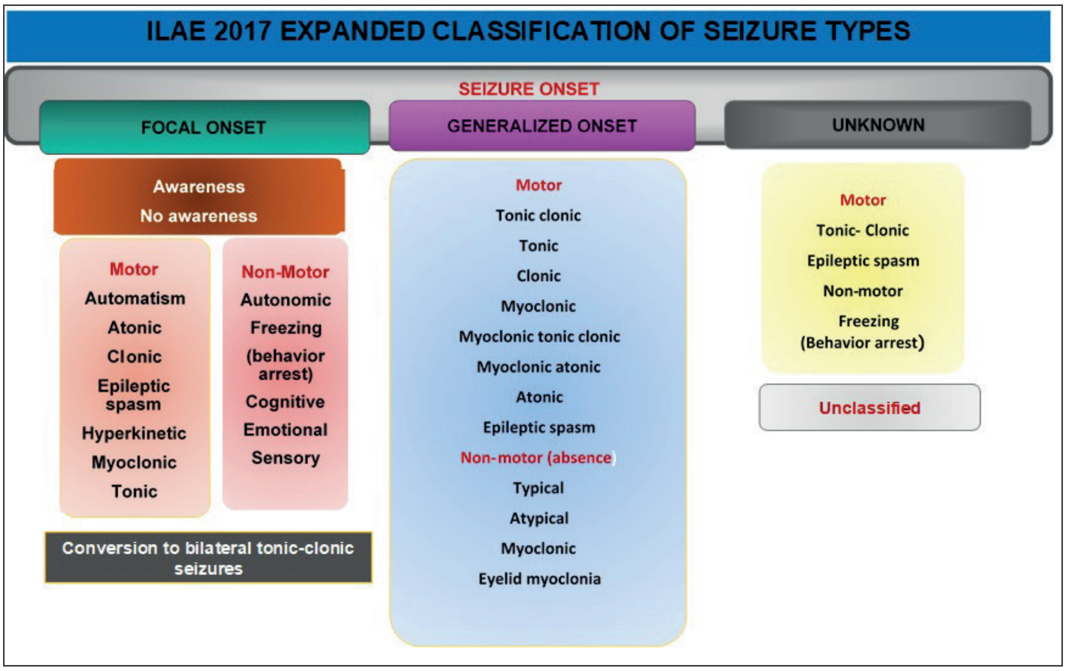

Figure 1. ILEA 2017 expanded classification of seizure types.

was defined as "before video-EEG monitoring classification". A second round of classification was performed upon watching the video records. This second classification was defined as "after video-EEG monitoring classification."

After finalizing the classification system, the seizures of all patients were reviewed in random order. Each of the pediatric neurologists provided a written independent assessment and classification of each seizure's symptomatology. In most cases, there was spontaneous agreement on the seizure classification. Video recordings and data were reviewed and discussed by the three experienced pediatric neurologists (HKU, EA, and AS). Inter-observer agreement was high (κ=0.95).

The 2017 ILAE classification was designed to include two versions, an expanded classification and a more basic classification. In order to allow one-to-one comparisons in this study, the SSC was included using the expanded version in the literature. The evolution of seizure symptomatology was expressed as a progression from one sei-

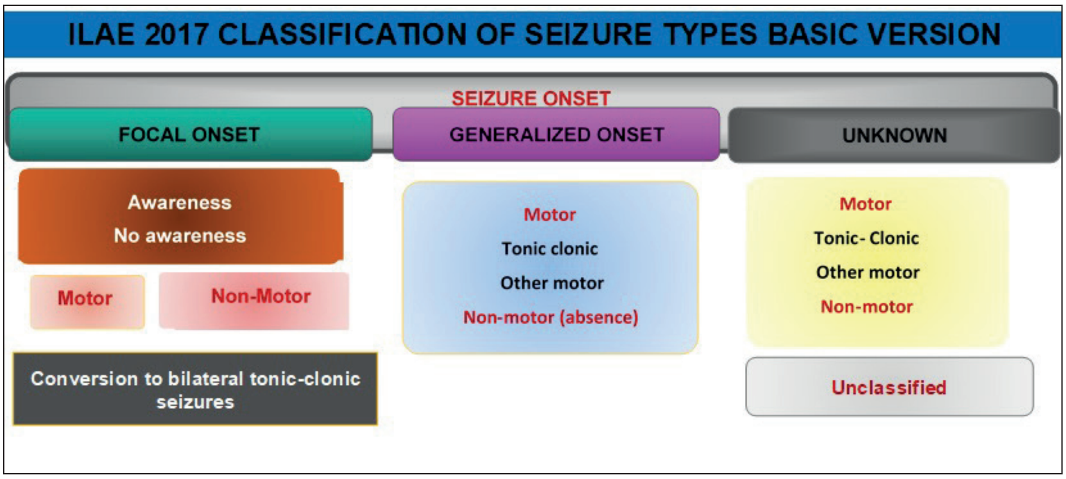

Figure 2. ILEA 2017 expanded classification of seizure types of basic version.

SSC-Extended	SSC-Basic
I. Epileptic seizure	I. Epileptic seizure
1. Aura	1. Aura
• Somatosensory aura*	
• Auditory aura*	
• Olfactory aura	
• Abdominal aura	
• Visual aura*	
• Gustatory aura	
• Autonomic aura*	
• Psychic aura	
2. Autonomic seizure*	2. Autonomic seizure*
3. Dialeptic seizure†	3. Dialeptic seizure†
• Typical dialeptic seizure*	
4. Motor seizure*	4. Motor seizure*
• Simple motor seizure*	• Simple motor seizure*
- Myoclonic seizure*	
- Epileptic spasm*	
- Tonic-clonic seizure	
- Tonic seizure*	
- Clonic seizure*	
- Versive seizure*	
• Complex motor seizure†	• Complex motor seizure†
- Hypermotor seizure†	
- Automotor seizure†	
- Gelastic seizure	
5. Special seizure	5. Special seizure
• Atonic seizure*	
• Hypomotor seizure†	
• Negative myoclonic seizures*	
• Astatic seizure	
• Akinetic seizure*	
• Aphasic seizure†	
II. Paroxysmal event	II. Paroxysmal event

* Left/right/axial/generalized/bilateral asymmetric.
† Left hemisphere/right hemisphere

Figure 3. Expanded and basic Semiological Seizure Classifications (SSC).

zure type to another (e.g., aura, dialeptic seizure, versive seizure, or automotor seizure). Seizures with poor-quality recordings deficient in sound or images and patients with pseudo-seizures were excluded. Only the first three seizures of patients with more than three seizures were classified.

ILAE (Figures 1 and 2)

Expanded and basic ILAE classifications before monitoring (based on information obtained from the parents of the patients).

Expanded and basic ILAE classifications after monitoring (based on video-EEG monitoring).

SSC (Figure 3)

Expanded and basic SSC classifications before monitoring (based on information obtained from the parents of the patients).

Expanded and basic SSC classifications after monitoring (based on video EEG monitoring).

Statistical Analysis

Statistical assessment was performed using SPSS 20 for Windows (IBM Corp., Armonk, NY, USA). The Kolmogorov-Smirnov test was used to assess whether the data complied with normal distribution. Numerical variables were shown as median (min-max). Categorical variables were presented as numbers and percentages. Kappa (κ) statistics and McNamara tests were used to evaluate the consistency of the SSC before and after EEG monitoring. Consistency was determined to be mild for $\kappa < 0.2$, fair for $\kappa = 0.21\text{-}0.40$, moderate for $\kappa = 0.41\text{-}0.60$, good for $\kappa = 0.61\text{-}0.80$, and excellent for $\kappa > 0.81$. Values of $p < 0.05$ were recognized as significant in statistical analyses.

Results

The study population consisted of 173 patients aged between 1 and 18 years with a median age of 11. Of these patients, 82.1% had typical seizures as described by their families (Table I). While 61.2% of the patients experienced a single seizure type, 19% had two types of seizures (Table I). Long-term video-EEG monitoring was applied for all patients and multiple seizure types were determined for only a small number of them (2.3%). A summary of seizure distribution with κ and *p*-values is given in Tables II and III. Among patients who had typical seizures as described by their families, there was good or excellent compliance with the basic 2017 ILAE classification for 60% of patients and moderate compliance for 20%. Meanwhile, 71.4% of patients had good or excellent compliance with the basic SSC (Table IV, Figure 4).

According to the "before video-EEG monitoring classification", 60 of 184 (32.6%) seizures with two semiologies, 29 (15.8%) seizures with three semiologies, 3 (1.6%) with four semiologies, and 1 (0.5%) with five semiologies could be classified according to the SSC. According to the "after video-EEG monitoring classification", 54 of 184 (29.3%) seizures with two semiologies, 37 (20.1%) seizures with three semiologies, 3 (1.65%) with four semiologies, and 3 (1.65%) with five semiologies could be classified according to the SSC (Table I).

Discussion

The interpretation of clinical seizure attacks is the cornerstone of the diagnosis of epilepsy and the correct classification of seizures is associated with successful therapeutic outcomes. Although the use of portable electronic devices in this area has increased, technological equipment cannot always be used at the time of the seizure due to panic within the family. Important clinical data are often obtained from descriptions of seizures of-

Table I. Demographic characteristics.

Demographic characteristics	Total population n=173
Gender	
Female	75 (43.4)
Male	98 (56.6)
Age	11 (1-18)
Age at onset of epilepsy	
<1 year	44 (25.4)
1-4 years	58 (33.5)
≥5 years	71 (41)
Types of seizures (seizures described to be typical by the family), n=184	
1 type of seizures	106 (61.2)
2 types of seizures	33 (19)
3 types of seizures	4 (2.3)
Seizures described to be typical by the family	
No	31 (17.9)
Yes	142 (82.1)
Seizure semiology before video-EEG monitoring	
1 type of semiology	91 (49.5)
2 types of semiology	60 (32.6)
3 types of semiology	29 (15.8)
4 types of semiology	3 (1.6)
5 types of semiology	1 (0.5)
Seizure semiology after video-EEG monitoring	
1 type of semiology	87 (47.3)
2 types of semiology	54 (29.3)
3 types of semiology	37 (20.1)
4 types of semiology	3 (1.65)
5 types of semiology	3 (1.65)

fered by the patients themselves and/or their families or caregivers. The present study is not an epileptic syndrome classification study; it is a study in which two different seizure classifications are compared in terms of being comprehensible for families and their convenience for daily use.

There is limited information available on the outpatient application of semiological seizure classification systems for children[4]. Nordli et al[1] found that for infants aged 1-26 months, classification should be made only based on clinical history and the ILAE classification is not appropriate. Kim et al[12] and Benbadis et al[13] compared the SSC and the 1981 ILAE seizure classifications for children. They concluded that multiple simultaneous seizures or seizures of sequential semiology can be successfully defined by the SCC; however, cases could not be easily classified into a single seizure type[12,13].

In the present study, the sequences of ictal semiology were diverse, and 93 of 184 seizures (50.5%) as evaluated before video-EEG and 97 of 184 seizures (52.7%) as evaluated after video-EEG showed two or more semiologies in a single incident (mean age of patients: 11 years). More than half of the seizures exhibited seizure evolution or involved different systems. As Luders et al[4] remarked, because the SSC is based entirely on what is observed during the ictal event, the system can describe concurrent or sequential ictal phenomena efficiently. Kim et al[12], Hirfanoglu et al[10], and Alan et al[14] found that more than half of the studied seizures showed two or more semiologies, thus exhibiting seizure evolution involving different areas (the mean ages of their cohorts were 7.7 years, 10.6 years, and 9.5±4.7 years,

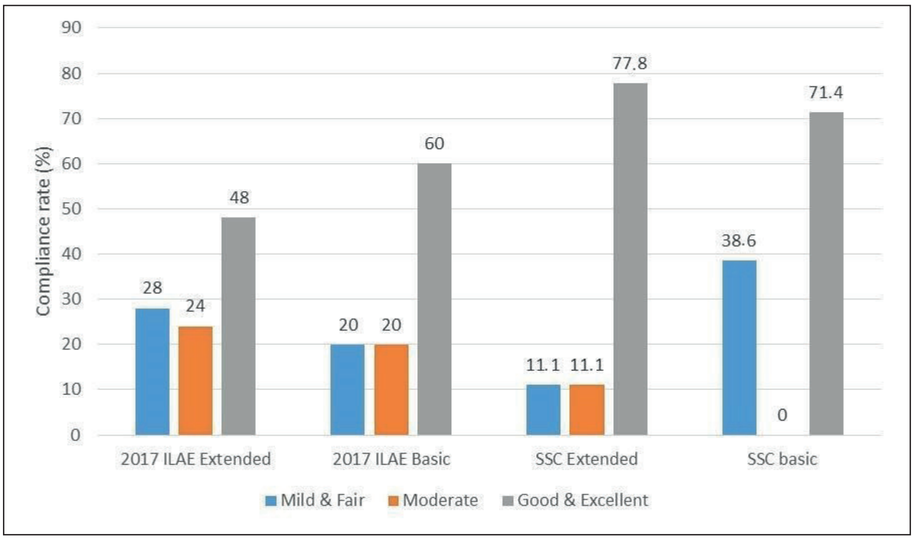

Figure 4. Comparisons of ILEA 2017 and semiological seizure classifications.

Table II. 2017 ILAE classification of epilepsy applied before and after monitoring.

	Seizures described to be typical by the family				
Classification	**Number before (%)**	**Number after (%)**	**Change (%)**	**κ value†**	***p***
Classification					
Focal	120 (65.2)	136 (73.9)	8.7	**0.771**	**<0.001***
Generalized	64 (34.8)	48 (26.1)	8.7	0.318	<0.001*
Focal					
Unknown awareness	13 (7.1)	2 (1.1)	6	0.117	0.017*
Aware	17 (9.2)	21 (11.4)	2.2	0.531	<0.001*
Disrupted awareness	90 (48.9)	113 (61.4)	12.5	**0.600**	**<0.001***
Focal type basic classification					
Conversion from focal to tonic-clonic seizures		12 (6.5)	23 (12.5)	6	0.531
<0.001*					
Motor	73 (39.7)	76 (41.3)	1.6	**0.696**	**<0.001***
Non-motor	35 (19.0)	37 (20.1)	1.1	**0.689**	**<0.001***
Focal expanded subtype					
Automatisms	28 (15.2)	30 (16.3)	1.1	**0.714**	**<0.001***
Tonic	19 (10.3)	14 (7.6)	2.7	**0.701**	**<0.001***
Myoclonic	3 (1.6)	2 (1.1)	0.5	0.392	<0.001*
Clonic	16 (8.7)	16 (8.7)	0	**0.795**	**<0.001***
Epileptic spasm	1 (0.5)	3 (1.6)	1.1	0.496	<0.001*
Hypermotor	8 (4.3)	11 (6.0)	1.7	**0.834**	**<0.001***
Sensory	3 (1.6)	5 (2.7)	1.1	**0.745**	**<0.001***
Emotional	4 (2.2)	5 (2.7)	0.5	**0.886**	**<0.001***
Autonomic	1 (0.5)	1 (0.5)	0	-0.005	0.941
Behavior arrest	25 (13.6)	26 (14.1)	0.5	**0.613**	**<0.001***
Generalized type basic classification					
Motor	57 (31.0)	41 (22.3)	8.7	**0.752**	**<0.001***
Non-motor/Absence	7 (3.8)	7 (3.8)	0	**0.703**	**<0.001***
Generalized expanded subtype					
Tonic-clonic	23 (12.5)	6 (3.3)	9.2	0.382	<0.001*
Tonic-jg	6 (3.3)	4 (2.2)	1.1	0.589	<0.001*
Atonic-jg	6 (3.3)	6 (3.3)	0	**1.000**	**<0.001***
Myoclonic-jg	8 (4.3)	6 (3.3)	1	**0.703**	**<0.001***
Myoclonic-atonic-jg	3 (1.6)	2 (1.1)	0.5	**0.797**	**<0.001***
Clonic-jg	1 (0.5)	4 (2.2)	1.7	0.389	<0.001*
Myoclonic-tonic-clonic	1 (0.5)	1 (0.5)	0	-0.005	0.101
Epileptic-spasm-jg	8 (4.3)	12 (6.5)	2.2	**0.683**	**<0.001***
Typical absence	6 (3.3)	2 (1.1)	2.2	0.492	<0.001*
Atypical absence	-	1 (0.5)	0.5	-	-
Myoclonic absence	2 (1.1)	2 (1.1)	0	**1.000**	**<0.001***
Eyelid myoclonia-absence	-	2 (1.1)	1.1	-	-

†A negative value is interpreted as a small number of seizures. *Values of $p < 0.05$ were considered significant

respectively). Hamer et al[15] reported that 53% of children experiencing seizures in the first 3 years of life had only a single semiology, while 42% of children had two or more different seizure types. However, our series represent an older age group compared to the studies mentioned here.

In this study, we were also interested in whether all seizures could be classified by the SSC and 2017 ILAE systems. We concluded that this was not possible. For example, a patient's seizure sequence could be dialeptic, autonomic, versive, and myoclonic. If these four semiologies appear equally distinctively, it will be difficult to representatively classify the series into one seizure type using the SSC. Therefore, seizures with multiple concurrent or sequential semiologies can be described well with the SSC but cannot be easily classified into a single seizure type. Since the SCC, as noted in the literature, depends entirely on what is observed during the ictal event, it can identify concurrent or consecutive ictal events very efficiently. Unfortunately, no annotations can eliminate the uncertainties inherent in a classification in actual clinical applications. At the same time, the 2017 ILAE classification system introduced several confusing points for cases such as the seizure sequence described here. The more signs and symptoms a seizure presents in the early stage, the more confusing the situation may be. The person performing the classification should choose the earliest evident symptom. However, observers may come to different conclusions and, therefore, classify the same seizure differently due to making different observations or due to information obtained from different people who saw the seizure. In fact, each classification inherently depends on personal judgment for each seizure. The accepted general opinion is that these systems are based on 80% certainty. Of course, there is no scale to measure the percentage of confidence in clinical practice and these findings are subjective. Such complications can be reduced by having knowledge of the typical patterns of common seizures. Adding additional descriptors to seizure types may provide better knowledge about the nature of the seizures. For the epilepsy community using the 2017 ILAE classification, the learning and adaptation curve will continue to improve. In this way, a consensus on determining which seizure types have which various symptoms or symptom groups will be developed over time. Past experience has shown that for the gradual integration of new classification systems, some terms from the old classification system should be used together with the new for a while[7].

Further classification of main semiologies showed that simple motor seizures were the most frequent (53%). The most common subtypes of simple motor seizures were tonic (22.8%), clonic (23.4%), and versive (6%) seizures. Previous reports on the SSC as applied for children showed similar results with simple motor seizures reported as the leading semiology by Kim et al[12], Hirfanoglu et al[10], and Alan et al[14] at rates of 47.6%, 55.7%, and 49%, respectively. In our study, the most common motor subtype was clonic seizure followed by tonic seizure. Similarly, Alan et al[14] and Kim et al[12] found the most common seizure

Table III. Semiological Seizure Classification (SSC) results for epilepsy before and after monitoring.

		Seizures described to be typical by the family				
	Classification	Number before (%)	Number after (%)	Change (%)	κ value†	*p*
	Aura	39 (21.2)	27 (14.7)	6.5	**0.743**	**<0.001***
	Autonomic finding	6 (3.3)	1 (0.5)	2.8	0.279	<0.001*
	Dialeptic	85 (46.2)	83 (45.1)	1.1	**0.671**	**<0.001***
	Motor seizure	150 (81.5)	153 (83.2)	1.7	**0.683**	**<0.001***
	Simple	105 (57.1)	99 (53.8)	3.3	**0.846**	**<0.001***
	Tonic	30 (16.3)	42 (22.8)	6.5	0.588	<0.001*
	Myoclonic	18 (9.8)	18 (9.8)	0	**0.692**	**<0.001***
	Epileptic spasm	9 (4.9)	15 (8.2)	3.3	**0.645**	**<0.001***
SSC	Clonic	23 (12.5)	43 (23.4)	10.9	0.529	<0.001*
	Tonic-clonic	38 (20.7)	28 (15.2)	5.5	**0.706**	**<0.001***
	Versive	13 (7.1)	11 (6.0)	1.1	**0.733**	**<0.001***
	Complex	43 (23.4)	43 (23.4)	0	**0.757**	**<0.001***
	Hypermotor	8 (4.3)	12 (6.5)	2.2	**0.789**	**<0.001***
	Automotor	34 (18.5)	39 (21.2)	2.7	**0.676**	**<0.001***
	Gelastic	4 (2.2)	4 (2.2)	0	**1.000**	**<0.001***
	Simple + Complex	2 (1.1)	11 (6.0)	4.9	0.138	0.008*
	Special seizures	10 (5.4)	9 (4.9)	0.5	**0.834**	**<0.001***
	Atonic	9 (4.9)	8 (4.3)	0.6	**0.938**	**<0.001***
	Hypomotor	-	-	-	-	-
	Negative-myoclonic	1 (0.5)	-	0.5	-	-
	Astatic	-	1 (0.5)	0.5	-	-
	Akinetic	-	-	-	-	-
	Aphasic	-	-	-	-	-

* Values of $p < 0.05$ were considered significant.

Table IV. Distribution of ILAE and SSC concordance (seizures defined to be typical by families).

		Number of parameters*	Mild & fair	Moderate	Good & excellent
2017 ILAE	Basic	10	20%	20%	60%
	Expanded	25	28%	24%	48%
SSC	Basic	18	38.60%	0.00%	71.40%
	Expanded	18	11.10%	11.10%	77.80%

*Families and parameters with EEG results have been included.

type to be tonic, but Hirfanoglu et al[10] found versive seizures to be the most frequent.

We have observed that simple motor and versive seizures showed better concordance (κ>0.60, Table III) than the moderate coefficient of concordance (κ=0.44) reported in the literature[8]. However, the versive seizures in the literature may not have been described by families as seizure components similar to tonic-clonic seizures.

Low concordance was determined for both the SSC and ILAE systems with the lowest concordance for autonomic seizures (κ=0.27 for SSC, κ=-0.005 for 2017 ILAE). While the seizures with the lowest adaptation in the SSC were simple + complex seizures (κ=0.13), in the 2017 ILAE system they were generalized seizures and myoclonic + tonic + clonic seizures (κ=-0.005). This may be due to the fact that they were perceived as components of each other. In the case of seizure types with focal or generalized onset, many motor symptoms can be seen, but it is not possible to say that the pathophysiology is the same for each category. A focal tonic seizure may have a mechanism different from that of a generalized tonic seizure as these types of seizures may have different prognoses, respond to treatments differently, and reflect different associations among demographic characteristics and epilepsy syndromes. The definition of these new seizure types will provide us with more information about them in the future and will also allow us to specify the associated syndromes more easily. For this reason, we think that the use of new definitions should be encouraged and, in particular, families and other clinicians should be educated on this issue. Consequently, a rational version of the SCC should consider that differences in seizure types may exist according to origin and semiology.

The second most common semiological subtype was dialeptic seizures (45.1%). Dialeptic seizures have an alteration of consciousness independent of ictal EEG manifestations as their main sign, so this subtype comprises both absence and complex partial seizures. Alan et al[14] found dialeptic semiology for 12% of all semiologies considered in their work. However, their series represented a younger age group compared to ours. Hirfanoglu et al[10] found dialeptic seizures to account for 21.1% of all possible semiologies. In our series, we found dialeptic seizures to represent 45.1% of the possible semiologies. Our patients are in an older age group compared to other series. However, the coefficient of concordance was 85/83 (κ=0.67) before and after dialeptic seizures among patients who had typical seizures as described by their families (n=184), it was 90/113 (κ=0.60) for focal impaired awareness seizures, and it was 7/7 (κ=0.70) for generalized non-motor absence seizures.

In agreement with the study conducted by Benbadis et al[13], focal impaired awareness seizures, also known as complex partial seizures (CPSs), constituted the most common ILAE seizure type in our patient group. This type includes several categories of semiological classification, and it is non-specific. The majority of patients are classified as having CPSs without any certain evidence for altered awareness as stated by Parra et al[2]. The term “CPS” is used in practice when there is only a small amount of characteristic evidence, such as the alteration of “complex” awareness. However, as stated by Benbadis et al[13], classifying almost everything as a CPS may result in serious consequences such as the inaccurate selection of medical therapy and improper use of invasive techniques or surgery. Some researchers[16,17] have recommended differentiating CPSs of temporal origin and other types of complex partial seizures.

The third most common semiological subtype was complex motor seizures (23.4%), predominantly reflecting automotor semiology. Automatism was seen at all ages in these children with changing repertoires and complexity by maturation.

Auras may be very challenging to define and classify in childhood, as physicians are only able to identify the presence of auras if the patient describes his or her sensorial experiences. In this study, auras were found to occur at a rate of

14.7%, which may be related to the mean age of our patient population. Kim et al[12] concluded that although older children felt and could express auras, 25% of them could not talk about their auras.

Gelastic seizures were low in number, but they had excellent concordance in contrast to previous findings available in the literature, while among special seizure types, atonic seizures had high concordance (κ=0.93). The fact that a higher coefficient of concordance was determined here in comparison to the results of a previous study performed at our center indicates that motor seizures are evaluated in a broad fashion and families were informed about this issue. The concordance was good for hypermotor and automotor seizures, which had a good topographic correlation[2,10].

Nordli et al[1] claimed in their study that application of the SSC is an appropriate method for seizure classification in outpatient clinics[10]. In their study of 78 patients, Benbadis et al[13] compared the SSC and the 1981 ILAE classifications for safety and applicability in daily clinical use. They suggested that since the SSC is based solely on clinical features with clinic-based data, it may be more appropriate for daily use. Hirfanoglu et al[10] also stated that the SSC might be more appropriate for daily use in their study of 90 patients. On the other hand, Parra et al[2] found the SSC to be more suitable in the setting of a tertiary epilepsy center with an epilepsy surgery program according to data from their pediatric and adult patients. In addition, they found better inter-observer agreement for the International Classification of Seizures than for the SSC[2].

Our results were all good and excellent for one out of two people for both the SSC and 2017 ILAE (expanded SSC, good + excellent: 77.8%, ILAE: 48% vs. basic SSC: 71.4%, ILAE: 60%). While it was seen that the coefficient of concordance was higher for the SSC than the 2017 ILAE system, these results have revealed that both classifications are suitable and sufficient for daily use. Accordingly, we think that, particularly for patients who experienced the same seizures during video-EEG as those typically described by the family, both classifications can be applied in terms of daily use, easy communication and applicability, and the high agreement of family reports with both the 2017 ILAE and SSC systems.

Consequently, in order to reflect the wide spectrum of epilepsy in the general population, medical principles should be based on information, such as ictal records from tertiary centers and data from patients treated in primary care. Our results show that changes in the traditional SSC can be easily adopted with training.

Conclusions

Video-EEG, as the best diagnostic method for detailed analysis of electroclinical events during seizures, does not involve significant medical risks. However, it requires certain resources, and it is expensive. Up to one week of inpatient follow-up is also needed, which is quite difficult for pediatric patients. Based on our findings, as a first step, we propose that patients, relatives, and caregivers be encouraged to make video recordings of seizures so that clinically based seizure definitions can be more accurate. In this age of portable electronic devices, this is technically possible. Such video registries may provide additional clinically useful information, reducing the number of patients requiring long-term video-EEG monitoring. As a second step, in general, parents can describe seizures very well. Evaluating each component of seizure semiology individually is particularly a safe method if seizure classifications are kept separate for seizure components. Although the SSC seems superior, we suggest that both the SSC and 2017 ILAE systems can be applied in daily use. Classification enables the rise of new concepts and better understandings for the treatment of patients with epilepsy. The continuing development of such classifications will lead to advancements for patients. The use of the 2017 ILAE classification in real-life settings will also lead to corrections. The expected result of the application of the 2017 ILAE classification system is the facilitation of interactions and communication between clinicians dealing with seizures, the non-medical community, and researchers. As information and interactions increase in the future, much better classification systems will be developed.

Authors' Contributions

Concept – H.K.U., E.A., K.A., T.H., A.S.; Design – H.K.U., E.A., K.A., T.H., A.S.; Supervision – H.K.U., E.A., K.A., T.H., A.S.; Data Collection and/or Processing – H.K.U., E.A., K.A., T.H., A.S.

Ethical Approval

Obtained.

Conflicts of Interest

The authors declare no conflicts of interest.

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